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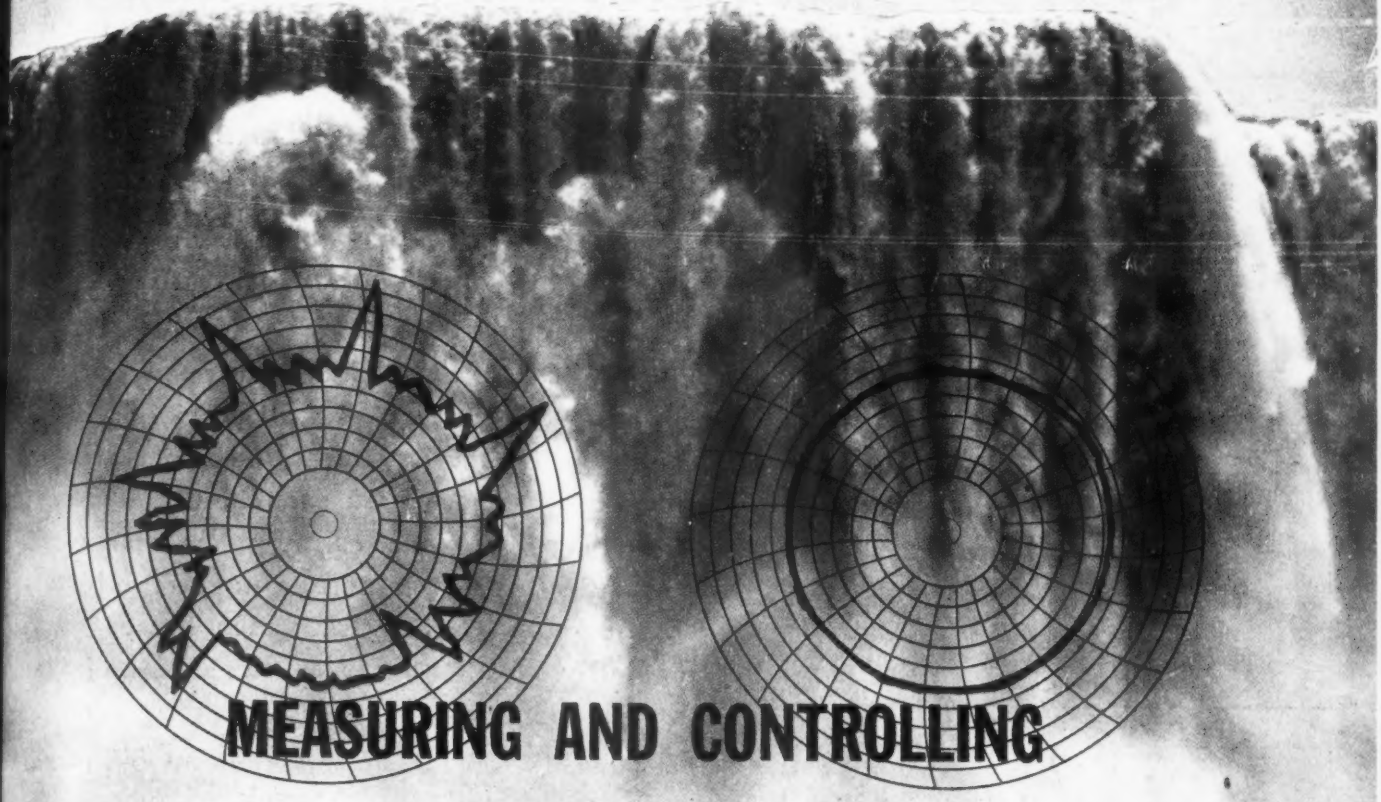
POWER

APRIL, 1945

R GENERATION, TRANSMISSION, APPLICATION AND THE ATTENDANT SERVICES IN ALL INDUSTRY

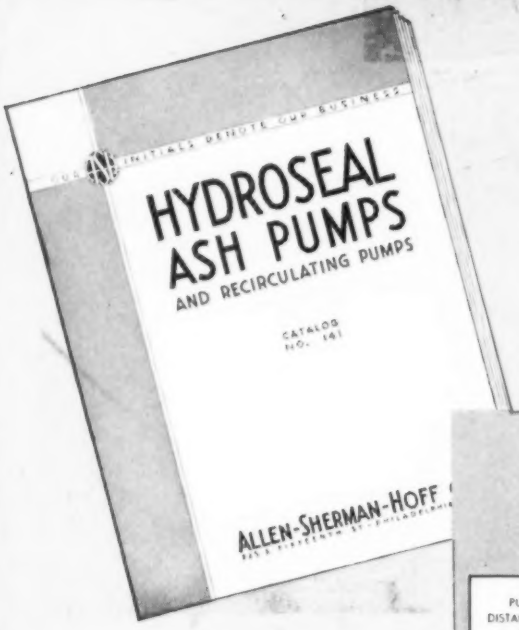
TECHNOLOGY DEPT.

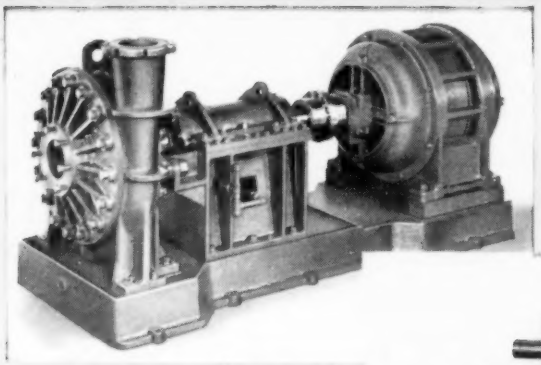


MEASURING AND CONTROLLING

LIQUID LEVEL

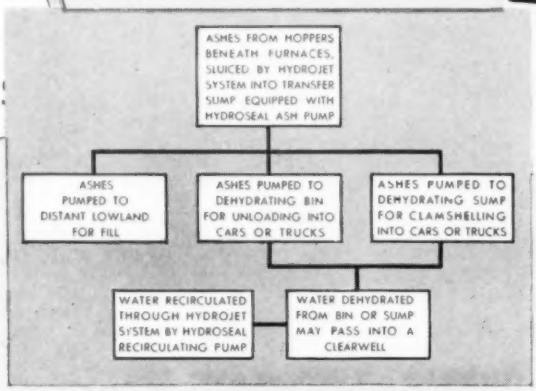
A 24-PAGE SPECIAL SECTION STARTING ON PAGE 63

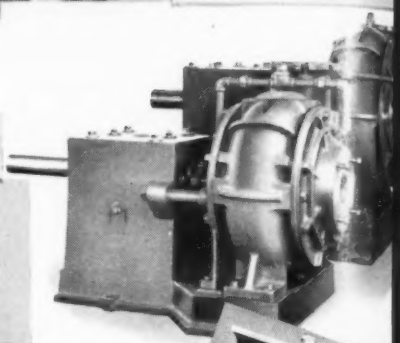




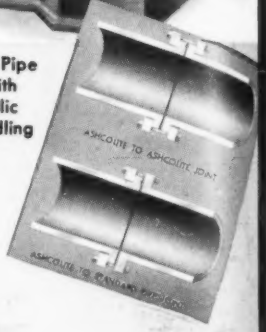
Hydroseal Recirculating Pump

Hydroseal Ash Pumps


ASHES FROM HOPPERS BENEATH FURNACES, SLUICED BY HYDROJET SYSTEM INTO TRANSFER SUMP EQUIPPED WITH HYDROSEAL ASH PUMP
ASHES PUMPED TO DISTANT LOWLAND FOR FILL
ASHES PUMPED TO DEHYDRATING BIN FOR UNLOADING INTO CARS OR TRUCKS
ASHES PUMPED TO DEHYDRATING SUMP FOR CLAMSHELLING INTO CARS OR TRUCKS
WATER RECIRCULATED THROUGH HYDROJET SYSTEM BY HYDROSEAL RECIRCULATING PUMP
WATER DEHYDRATED FROM BIN OR SUMP MAY PASS INTO A CLEARWELL

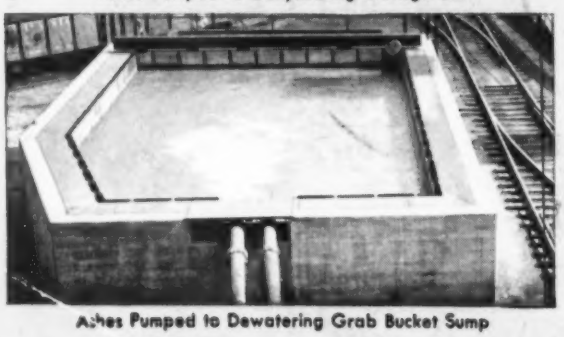


Ashcolite Pipe used with Hydraulic Ash Handling



Pumping Ashes to Distant Fill

Ashes Pumped to Dehydrating Storage Bin



Ashes Pumped to Dewatering Grab Bucket Sump

Guidebook For Planning Your Post War Ash And Dust Disposal

"PUMP YOUR ASHES" has been our cry, ever since the earliest days of the Hydrojet System. Hydroseal Pumps are now used under practically every conceivable condition, handling everything from stoker ash to precipitator dust. In practically every case, we have found that hydraulic ash handling is the most inexpensive method where the engineer considers maintenance, labor and power, in addition to first cost. . . . Hydroseal Ash and Recirculating Pumps are specially designed for economical handling of abrasive solutions. Before you get too far with your post war plans, get our Catalog No. 141, or talk to our nearest engineer.

HYDROSEAL PUMPS

ALLEN-SHERMAN-HOFF CO., 227 S. 15th St., PHILADELPHIA 2, PA. ***Offices & Representatives in Principal Cities***

POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer," and "The Stationary Engineer"), April, 1945, Vol. 89, No. 4. Published monthly with an additional Directory number in December. McGraw Hill Publishing Company, Inc. Publication office, 99-129 North Broadway, Albany 1, N. Y. Editorial and Executive Offices, 330 West 42nd Street, New York 18, N. Y. Entered as second class matter, August 25, 1936, at Albany, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, Power, 330 West 42nd Street, New York 18, N. Y. Subscription rates—U. S. and U. S. Possessions, $3.00 for one year, $4.00 for two years. Canada, $3.50 for one year, $5.00 for two years. Great Britain and British Possessions, 36 shillings per year. All other countries, $6.00 for one year, $9.00 for two years. Single copies 35 cents.

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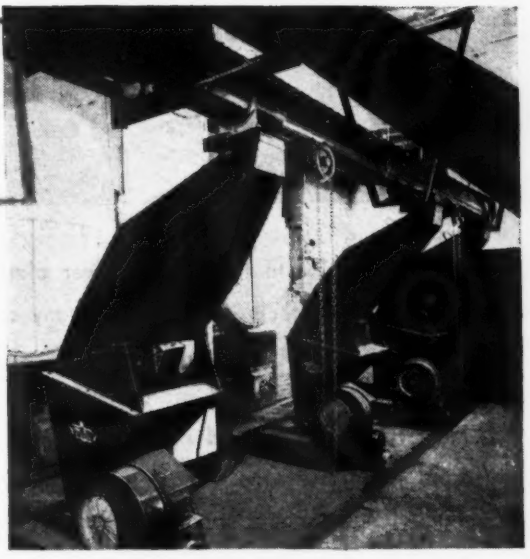
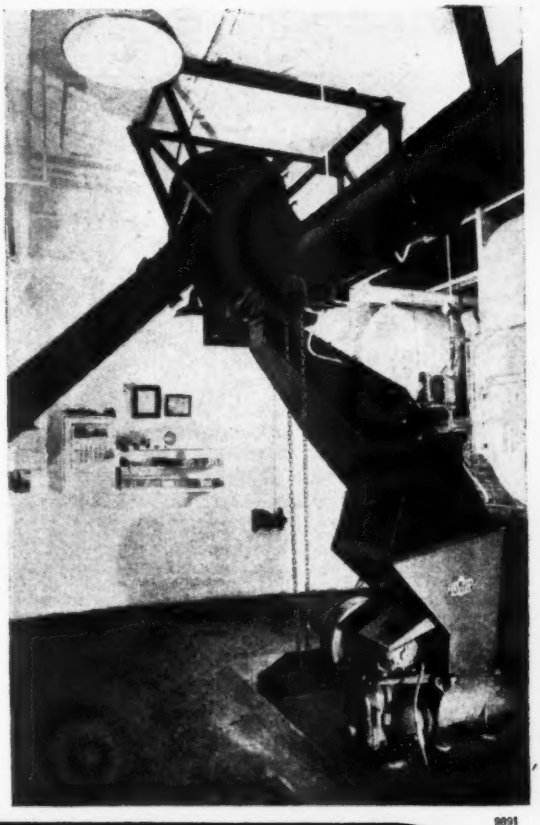
Bulk-Flo Screw Conveyor Stoker Combination

CUTS STEAM COST





• A unique combination of automatic coal conveying, distributing and stoker firing is proving to be a fine investment in cutting steam and labor costs and improving boiler efficiency in a low pressure boiler installation.

Coal is conveyed from storage to a point above the stoker hoppers by means of a Link-Belt Bulk-Flo conveyor . . . is distributed to hopper spouts by a Link-Belt screw conveyor . . . and is automatically fired by Link-Belt industrial type stokers.

Conveyor operation is semi-automatic. Limit switches in the enclosed spouts shut off the motors when the spout and hopper are filled. Other switches in the stoker hopper may be set to restart the system when the coal is consumed to a low level, provided that the gates are properly manipulated. The operator is relieved of considerable routine attentiveness. Dust-tight operation assures cleanliness. An additional feature is the use of hinged spouts to permit access to the boilers for cleaning.

We'll be glad to make a study of your boiler room coal handling problem and submit recommendations.

●

Bulk-Flo combines in a single flexible unit the functions of an elevator, conveyor and feeder, to handle many flowable materials under all conditions of loading. A simple, low-cost solution to many handling problems.

9891

LINK-BELT

Coal and Ashes Handling Equipment

LINK-BELT COMPANY

Chicago 8, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices in principal cities.

. . NINE PROVED WAYS TO

When it comes to translating power plans into power plants, the Babcock & Wilcox Company can supply reliable and efficient boiler units complete with all essential components from fuel preparations and burning equipment to breechings and stacks. The company thus has control over both the designing and application of the equipment and coordinates the various elements to assure maximum dependability and economy of performance.

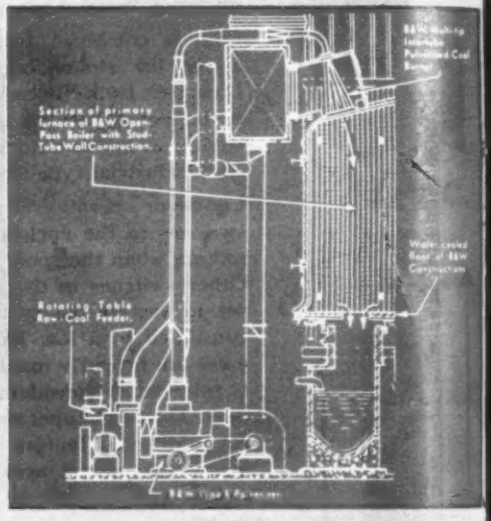
Much of the component equipment shown on these pages can be applied to modernizing, and thereby step up the efficiency of, existing power facilities.

When you select B&W steam-generating equipment for large or small plants, you get the benefit of over 60 years specialized experience in designing and fabricating boilers and related equipment with a long record of highly satisfactory service.

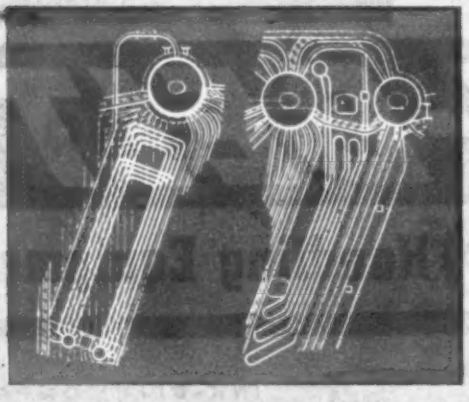
SEVEN STEPS TO A MODERN POWER PLANT

1. List minimum equipment and material essential to keep plant running for perhaps three years.
2. Meter, check, or estimate use of kwhr, steam, water, and air for each plant use, keeping postwar expansion possibilities in mind.
3. Make rough plan of the entirely new plant you would want to serve these needs. Secure costs of equipment and construction from consulting engineer or direct from manufacturers.
4. Compare new-plant plans with existing layout to find points of parallel arrangement, suitable locations for needed new items, building changes and the like.
5. Estimate fuel, labor and perhaps maintenance savings for each step of the modernization.
6. Calculate how long each individual improvement will take to pay for itself.
7. Prepare brief report suggesting that needed steps be approved first. Optional improvements can then be examined individually on the basis of the savings each will effect.

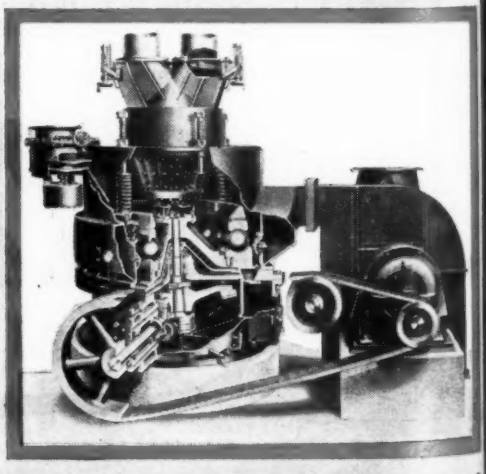
From POWER, December 1944.



B&W DIRECT-FIRING PULVERIZED-COAL SYSTEM. B&W direct-firing pulverized-coal system has advantages in ease of operation, reliability and upkeep that make it economical for small as well as large boilers. It is readily applied to oil-fired boilers for conversion to coal firing.

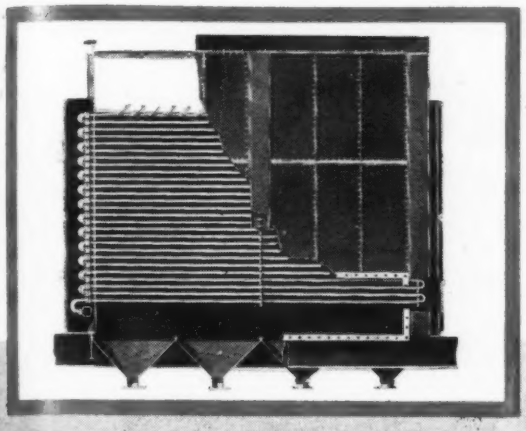


SUPERHEATERS. B&W Superheaters are properly designed and fabricated, with respect to steam and gas flow, to function efficiently with boilers designed and built by B&W. Available in both draining and non-draining types as shown.

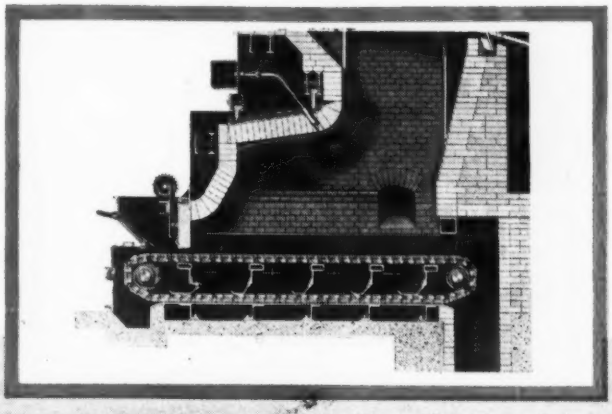


B&W PULVERIZERS. The simplicity and sturdiness of B&W ball-bearing type pulverizers assure high availability with low maintenance in direct-firing pulverized-coal systems. They provide consistently high fineness and respond quickly to changes in load with automatic control of raw-coal feed.

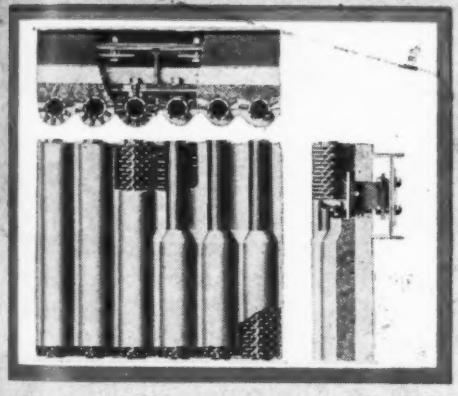
BOOST BOILER EFFICIENCY



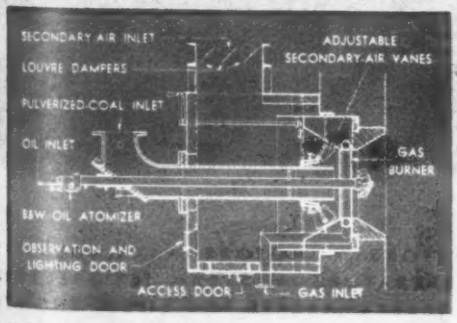
ECONOMIZERS. B&W Economizers effect appreciable savings in fuel and can be built to meet the size and pressure requirements of any installation. The Return-Bend Economizer shown can be easily cleaned, and pressure parts may be inspected externally while in service.



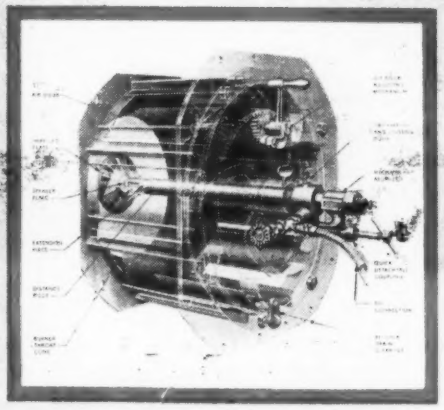
CHAIN-GRATE STOKERS. Babcock & Wilcox Chain-Grate Stokers are widely used with free-burning bituminous coal, anthracite, lignite, and coke breeze. They can be furnished for natural, induced, or forced draft, depending upon operating conditions.



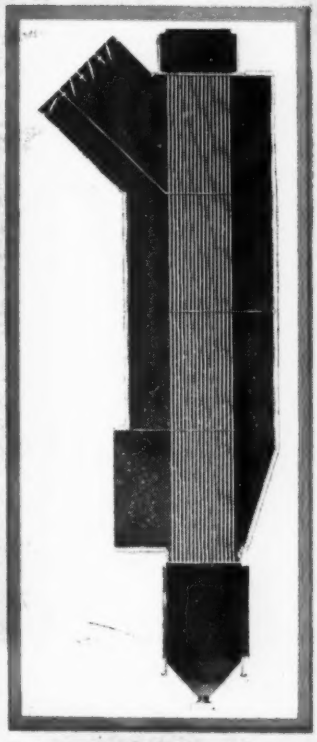
WATER-COOLED FURNACE CONSTRUCTIONS. B&W Water-Cooled Furnace Constructions are extensively applied for partial or complete water cooling of furnaces of all sizes, shapes, and forms, and with all fuels and combustion methods. Studded-tube type of construction is shown.



MULTIFUEL CIRCULAR BURNER. Pulverized solid fuels, oil, and gas are burned singly or in any combination with this burner. It provides a single means of efficiently burning a wide range of fuels, permitting advantage to be taken of variations in the availability and market prices of these fuels.



OIL BURNERS. B&W Oil Burners effect rapid and complete combustion at all rates of fuel feed, using mechanical, steam, or steam-mechanical atomizers, depending on the oil and operating conditions. Available in a range of heat liberating capacities that meet all requirements.



AIR HEATERS. B&W Tubular Air Heaters are inherently tight and efficient, and are easy to keep clean. Available in multi-pass gas flow type, as shown, or longitudinal gas-flow type, and in sizes to meet the requirements of any boiler installation.

THE BABCOCK & WILCOX CO. • 85 LIBERTY STREET, NEW YORK 6, N. Y.

BABCOCK & WILCOX

G-294G

STEAM TURBINES • GENERATORS • MOTORS • CONDENSERS
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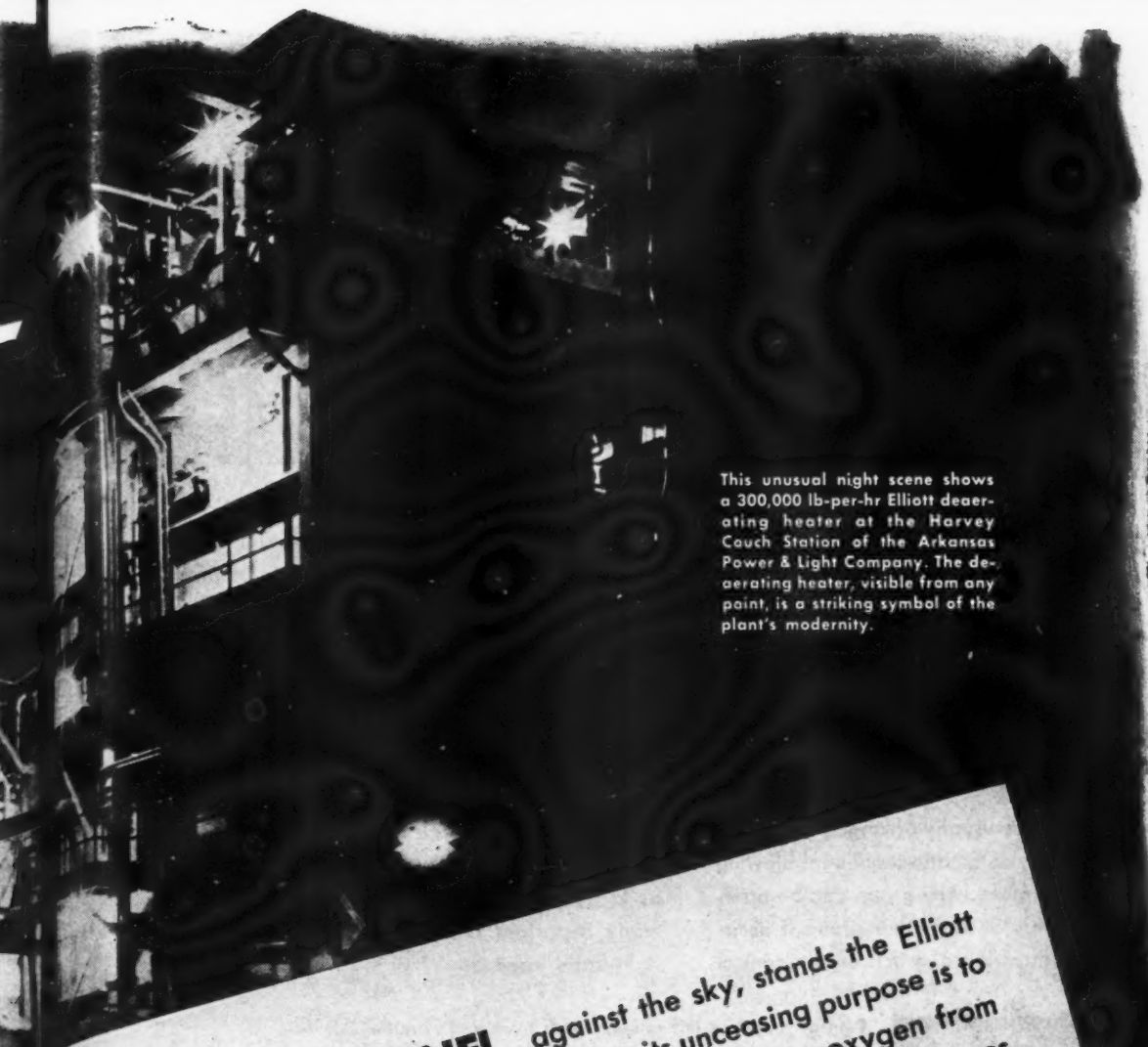
ELLIOTT DEAERATING FEE



This unusual night scene shows a 300,000 lb-per-hr Elliott deaerating heater at the Harvey Couch Station of the Arkansas Power & Light Company. The deaerating heater, visible from any point, is a striking symbol of the plant's modernity.

LIKE A SENTINEL, against the sky, stands the Elliott deaerating heater. It is a sentinel, for its unceasing purpose is to guard the plant by removal of corrosion-causing oxygen from boiler feedwater. It protects boiler tubes, piping, valves, pumps —all water-handling equipment. And while giving this protection, it also provides feedwater heated to the temperature of saturated steam. Night and day this process goes on, quietly, automatically, with no fuss or trouble.

Thousands of plants large and small have used deaeration since Elliott engineers pioneered its development some years ago. This pioneering is still going on—in more and more efficient and economical applications, in the closer fitting of Elliott deaerating heaters to specific conditions. You will find it interesting to discuss your deaeration problem with Elliott engineers.

N-983

ATER HEATERS ***For boiler plant security and economy***

DIAMOND *Automatic Sequential*

HAS MANY IMPORTANT ADVANTAGES

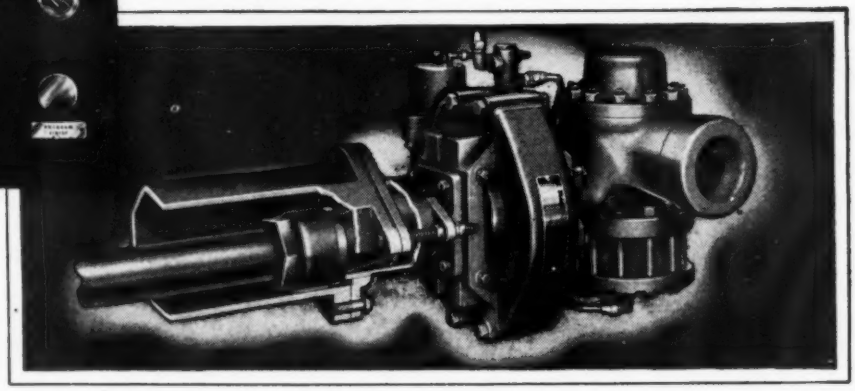
Description—All soot blower units on the boiler, superheater, economizer and air heater (whether fixed element, retracting or telescopic) are controlled from a single panel such as the one shown below. To begin the cleaning of the entire unit, simply press one button marked "start;" all blowers then operate in correct sequence without attention.

The soot blowers are usually arranged in groups; within each group, automatic sequential blowing of the units takes place. Any group can be operated independently of any other group if desirable by simply throwing a switch on the control panel. Blowing sequence of the units in any group can also be easily changed to suit conditions.

The compressed air for cleaning is discharged from the element nozzles in a series of short puffs. At each puff, the element is automatically repositioned. Spreading the cleaning cycle over a longer period of time permits use of a very small compressor.

The Diamond Automatic Sequential Soot Blower System has been in central station use on boilers as large as 900,000 lb/hr units since 1940. Its many important features are discussed on the right-hand page.

Program panel at left controls both fixed and retracting blowers arranged in three groups; any desired number of groups can be had when system is designed. Entire soot blowing system is operated in correct sequence by simply pushing "start" button.



Shown above is the Diamond Air Puff Soot Blower having element permanently installed inside the setting; various types of retracting soot blowers are also used in the Diamond Automatic Sequential Air Soot Blower System.

DIAMOND POWER

AIR SOOT BLOWER SYSTEM

CORRECT CLEANING ASSURED — 1

The "human element" is entirely eliminated from soot blowing; the automatic sequential operation assures positive operation of each blower unit in correct sequence and at right speed every time. No blower unit can be overlooked by careless operator.

SAVES LABOR — 2

Automatic sequential operation eliminates need for an attendant to drain the piping, warm it up, and then operate each individual blower unit. On one medium size boiler this labor saving is estimated at more than $3000 per year.

NO FEED WATER MAKEUP — 3

Using compressed air instead of steam as the cleaning medium, there is no condensate loss due to soot blowing. This is particularly important where makeup water is a problem.

SAVES FUEL — 4

Experience gained during several years' operation on a number of installations indicates that automatic sequential air puff soot blowing uses only ⅓ to ⅔ of the energy from the coal pile that is needed for steam blowing.

ELIMINATES STACK DISCHARGE NUISANCE — 5

Intermittent operation expels the soot from the boiler in small quantities that are readily handled by the dust collector. In an installation without dust collectors, it has permitted daylight blowing in a metropolitan district having a smoke abatement ordnance.

REDUCES MAINTENANCE — 6

Experience on two 900,000 lb/hr boilers placed in operation in 1940 and one 900,000 lb/hr and one 550,000 lb/hr units installed in 1942 has proved the maintenance cost is unusually low.

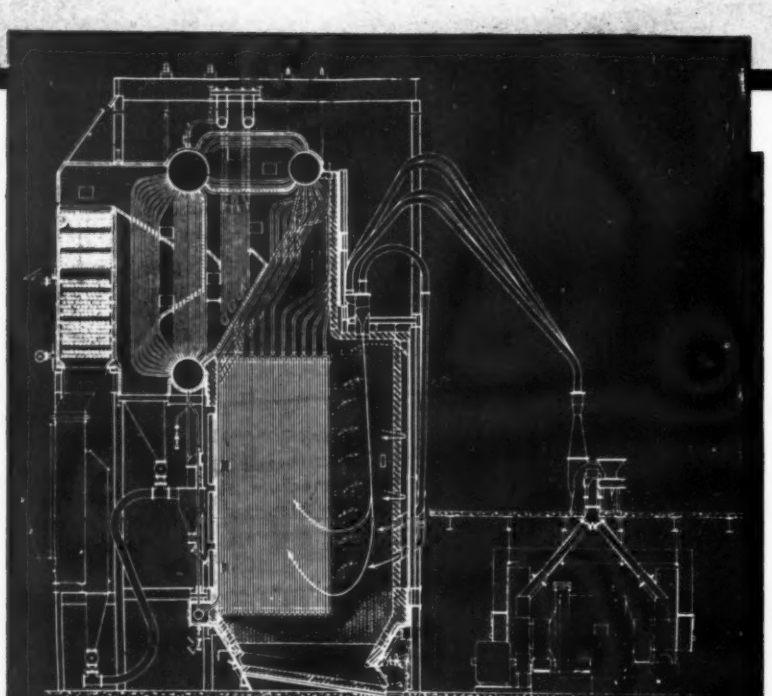
Among the other advantages is the theoretically better cleaning with air from a given nozzle because of the greater density of air. If you are interested in further information, ask for Bulletin No. 956 which illustrates and describes an installation of Diamond Automatic Sequential Air Puff Blowers in a prominent eastern central station.

DIAMOND SPECIALTY CORP. DETROIT 31, MICHIGAN

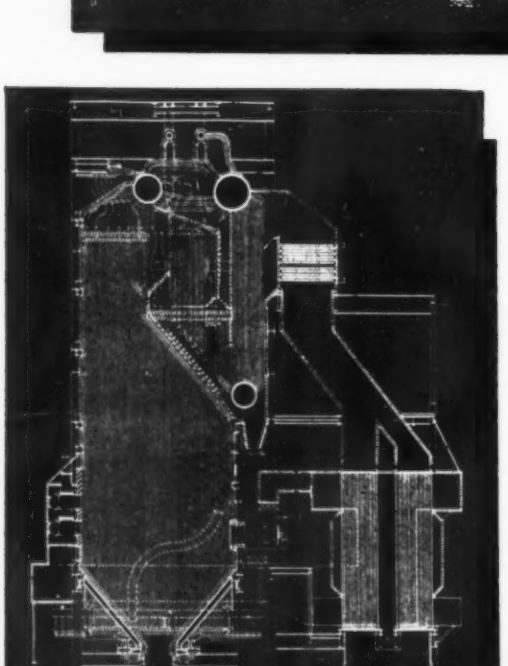
DIAMOND SPECIALTY LIMITED • Windsor, Ontario

STEAM GENERATORS

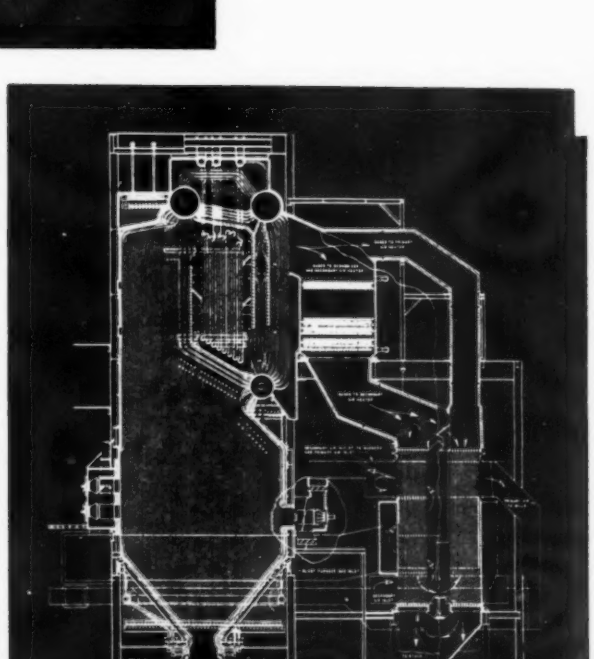
CAPACITIES



Capacity 165,375 lb. steam per hour, pressure 900 psi and final steam temperature 788 deg. F. Fuel: pulverized coal.



Capacity 385,000 lb. steam per hour, pressure 1050 psi and final steam temperature 900 deg. F. Fuel: pulverized coal and blast furnace gas.



Capacity 500,000 lb. steam per hour, pressure 1050 psi and final steam temperature 900 deg. F. Fuel: pulverized coal and blast furnace gas.

FW

FOSTER

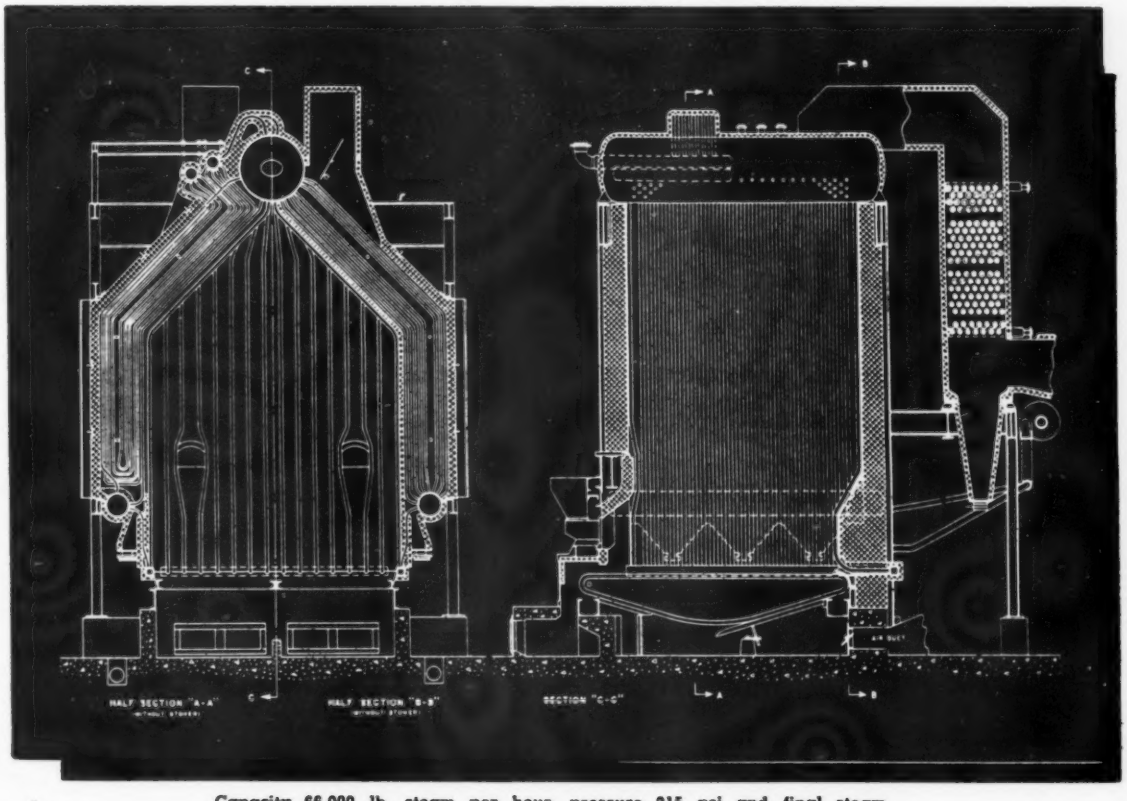
FOR RUSSIA . . .

66,000 TO 500,000 LB. STEAM PER HOUR

THE steam generators shown in the accompanying drawings represent 23 of the over 100 boilers that Foster Wheeler has designed and built for Russia during the past two years.

Their capacities range from 66,000 to 500,000 lb. steam per hour with pressures from 315 psi to 1050 psi and final steam temperatures from 707 deg. F. to 900 deg. F. To accommodate the variety of fuels available, these units are designed for stoker, pulverized coal and blast furnace gas firing.

FOSTER WHEELER CORPORATION, 165 BROADWAY, NEW YORK 6, N. Y.



Capacity 66,000 lb. steam per hour, pressure 315 psi and final steam temperature 707 deg. F. Fuel: coal on stokers or blast furnace gas.

WHEELER

Scovill Tube News

Vol. 3 SCOVILL MANUFACTURING COMPANY, Waterbury 91, Conn. No. 1

Hints for Controlling Tube Corrosion

An important part of Scovill service to condenser and heat exchanger tube users is practical aid in providing protection against troubles which cannot be foreseen at the time of installation.

This service is furnished in several ways — through personal calls by our engineers, through literature such as the Scovill Condenser Tube Booklet, and through the suggestions, like the following, given in Scovill Tube News, published regularly in this magazine.

WHAT TO DO

1. Select the right tube alloy for the job. Scovill *Service in Metals* can help you. A well-equipped and competently-staffed metallurgical and chemical laboratory is available for this purpose.

2. Install tubes carefully, avoiding undue stressing of the metal. Scovill *Service in Men* will help you here, and you can also obtain valuable information on proper installation practice from Scovill *Service in Manuals*.

3. Maintain streamline design at inlet ends of tubes.

4. Provide adequate support for tubes between tube sheets.

5. Eliminate, insofar as possible, turbulent flow of circulating water as the result of obstructions in the water box, improperly-aligned pump impeller, abrupt change in direction of water flow, etc.

OTHER PRECAUTIONS

1. Don't neglect adequate screening of the circulating water.
2. Don't allow cracks, crevices or other recessed openings between tubes and tube sheets, support plates, baffles, etc.
3. Don't permit air to become entrained with circulating water.
4. Clean tubes periodically, particularly if harmful deposits enter and lodge in tubes.
5. Don't overlook possible hot spots or other local overheating of tubes, due to direct impingement of hot gases, vapors, etc., or heavy deposits of scale, etc.

Scovill Seamless Condenser Tubes

From raw material to finished product, each step in the manufacture of Scovill Seamless Condenser Tubes is performed on modern machines and equipment by careful, skilled operators. Process inspection, a rigid finish inspection and constant metallurgical supervision are all an integral part of the manufacturing procedure.

That is the reason for the uniform high quality of Scovill Tubes. That is the reason for enviable service records of Scovill Tubes in the field.

But Scovill interest in condenser tubes goes far beyond their manufacture. Scovill has pioneered in the study of condenser tube corrosion and, of more importance, in ways and means of combating corrosion so that maximum tube life may be assured under any particular service conditions. Scovill engineers are well qualified to study your particular problems and to offer suggestions for overcoming them. Scovill engineers are competent through training and experience to make field inspections of condenser tube installations followed by recommendations and suggestions for improving tube life. Wherever necessary, such inspection and examination can be supplemented by studies of individual corrosion problems in our metallurgical and chemical laboratories.

Thus, Scovill is ready to meet your condenser tube requirements by manufacturing tubes in a complete range of sizes and alloys and, in addition to this *Service in Metals*, also offers *Service in Men* and *Service in Manuals*.

For further demonstration of *Service in Manuals*, including more detailed discussion of the Do's and Don't's mentioned above, write for a free copy of "Condenser Tube Booklet", addressing Scovill Manufacturing Company, 13 Mill Street, Waterbury 91, Conn.

THIS IS NUMBER FOURTEEN in a Series of Scovill Advertisements to help you get longer life from condenser and heat exchanger tubes.

Scovill
MANUFACTURING COMPANY
WATERBURY, CONN.

SCOVILL CONDENSER TUBES

ONE PRODUCT... THREE SERVICES

Service in Manuals... Service in Metals... Service in Men

The turbine blades were pitted

Serious corrosion developed in a turbine in a New York brewery. A private water consultant and a consulting engineer both laid the blame on chloride in the boiler water, claiming that this was carried over into the turbine with the steam. They were forced to this conclusion because they *took it for granted that the corrosion occurred during the operation of the turbine.*

Hall engineers, however, had tested the steam and found no carryover of chloride, *so they knew that corrosion occurred during stand-by.* Examination had showed considerable moisture in the turbine during stand-by condition.

A check for possible sources of moisture revealed evidence of leakage of 400 lb. steam and of 60 lb. steam, but the major source was found elsewhere. The leak-off connections on the carbon seal rings drained to the barometric condenser hotwell. The end of the drain was well below the surface of the salt water in the hotwell, and there was no check valve in the line.

Thus, every time the turbine was shut down, hot salt water was siphoned back into it.

These conditions were readily corrected, the turbine was kept dry during stand-by, and the trouble stopped.

The alternative proposal, based on the assumption of chloride carryover, called for the installation of an evaporator to supply the whole system with distilled water — a procedure which would have been both expensive and ineffective.

Hall service engineers take nothing for granted. They *check all factors involved in boiler performance* and, in the event of trouble, trace that trouble down to its source.

Every plant that generates its own steam power can profitably use Hall Service.

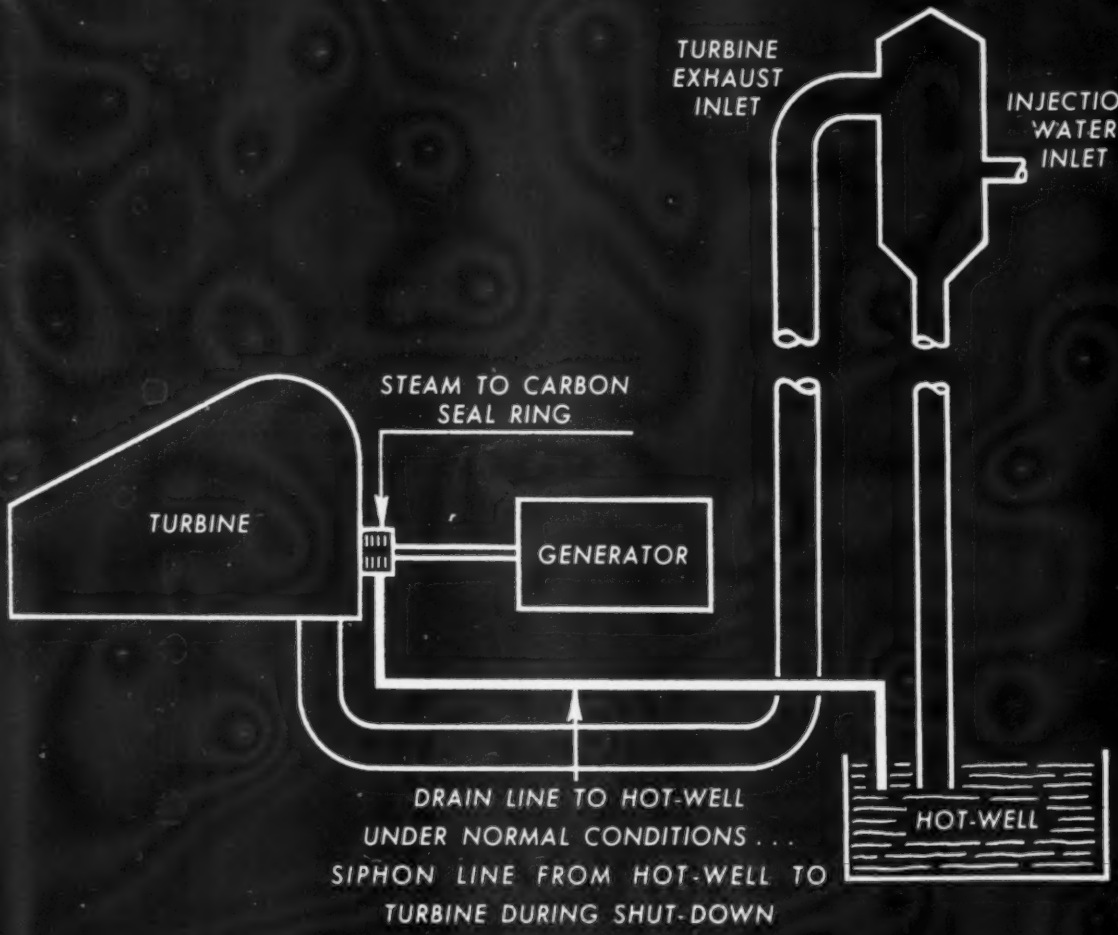
Write us for full information.

HALL SYSTEM *of Boiler Water Conditioning*

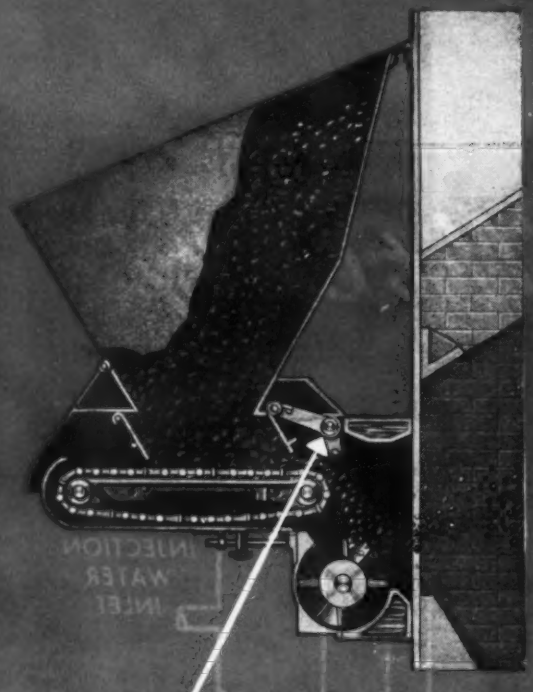
HALL LABORATORIES, INC. · HAGAN BUILDING · PITTSBURGH 30, PA.

A subsidiary of Hagan Corporation

but steam was proved *"Not Guilty"*


TURBINE EXHAUST INLET
INJECTION WATER INLET
STEAM TO CARBON SEAL RING
TURBINE
GENERATOR
HOT-WELL
DRAIN LINE TO HOT-WELL UNDER NORMAL CONDITIONS . . . SIPHON LINE FROM HOT-WELL TO TURBINE DURING SHUT-DOWN

HAGAN
HALL
BUROMIN
CALGON



NON-CLOG SAFETY FEATURE PREVENTS JAM-UPS

Tramp iron and other foreign objects in your fuel won't jam up and damage the Æ Perfect Spread Stoker. Small objects pass right through onto the grate, while infrequent larger pieces stop the feeder without harm. The feeder can be cleared and started again by simply lifting the cover and making a minor adjustment—without special tools—without removing the mechanism. This exclusive Non-Clog Safety Feature gives you quiet, uniform operation and non-stop firing.

BURNS ALL KINDS OF SOLID FUEL

WHY WORRY ABOUT coal availability and prices? Here's a stoker that efficiently burns so many kinds and grades of solid fuels, that you can easily keep up with changing conditions while producing more steam at lower cost.

It's the Æ Perfect Spread Stoker, a compact, completely automatic fuel-firing unit for high or lowest grade coals, coke breeze or sawdust. You can even burn corn cobs, hogged fuel, wood refuse, plant refuse and by-products for still greater economy.

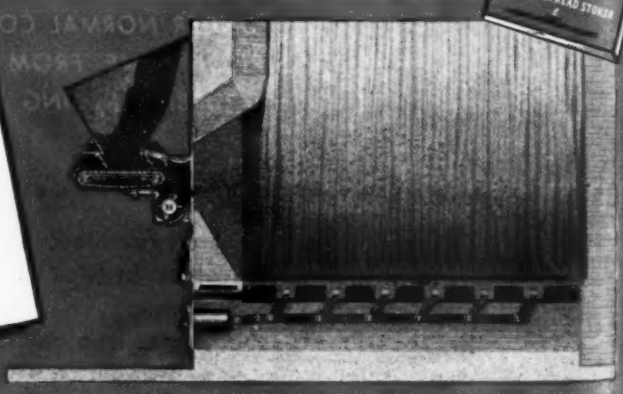
This dependable, extremely quiet-running stoker has many more features that may fit perfectly your present and future needs. Because its advanced design is "streamlined" in appearance, principle and operation, it also "streamlines" your fuel bills and boiler room practices. Be sure to get *all* the details. Write today for the Æ Perfect Spread Stoker bulletin.

If Your Steam Requirements Call for 175 H. P. up to 200,000 lbs. per hour—

YOU NEED THIS BULLETIN

Write us. 2400 Aramingo Ave., Philadelphia 25, Pa.

Æ PERFECT SPREAD STOKER



Other Æ Products: Æ-Taylor Stokers, Ljungstrom Air Heaters, Marine Draft Accelerators, Zero-Slow Field Pumps, Diamond Face Grinders

AMERICAN ENGINEERING COMPANY

PHILADELPHIA 25, PA.

Copyright 1945, American Engineering Co.

IT COSTS NOTHING TO FIND OUT HOW TO...

SAVE on POWER COSTS

IF COSTS — consistent with dependability and quality—are to be the basis of your new power plant equipment, then you want to know how to save on stoker installation and operation, while producing more steam more economically.

You may find the answer to your specific problems in the improved Taylor Stoker—a stoker with many new features and advantages supplementing its time-tested and proved principles of combustion. Each of these improvements is worth studying in detail . . . for details often mean the difference between choosing a stoker for the job, and choosing the *best* stoker.

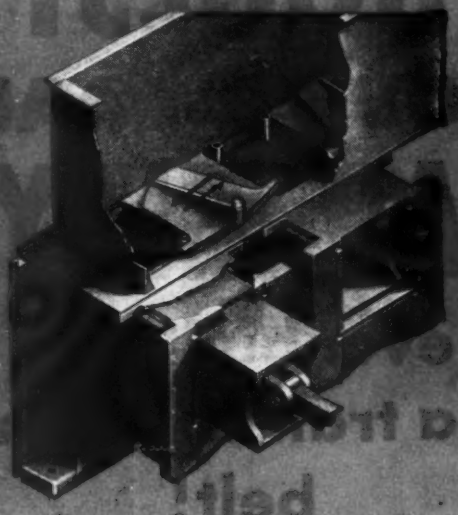
The new Type "R" Taylor Stoker booklet costs you nothing and may save you much. Write for it today . . . it will be sent without delay.

IF YOUR Steam Requirements Call for 20,000 to 500,000 lbs. per hour—

YOU NEED THIS BOOKLET

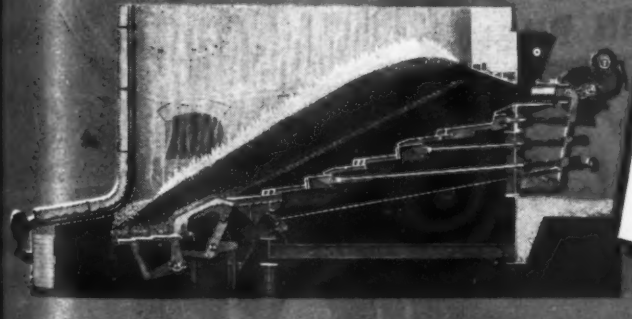
Write us. 2400 Aramingo Ave., Philadelphia 25, Pa.

ANOTHER IMPROVEMENT IN THE TYPE "R" TAYLOR STOKER



AGITATOR PREVENTS B-R-I-D-G-I-N-G IN COAL HOPPER

Wet or partially frozen coal is prevented from packing and "bridging" in the stoker hopper by unique agitators. Operated by alternating strokes of the coal rams, a series of oscillating agitators located between the rams prevents bridging and keeps coal flowing. Each coal ram gets a *full* charge every stroke and a uniform fuel bed is maintained.



Æ TAYLOR STOKERS

AIR-COOLED & WATER-COOLED

Other Æ Products: Æ-Parfect Speed Stoker, Le-Bel Boiler, Marine Deck Auxiliaries, Dole-Shaw Fluid Power, Diamond Face Grinders

AMERICAN ENGINEERING COMPANY

PHILADELPHIA 25, PA.

HIGHEST POWER-LOAD CAPACITY ever built into a transmission belt!

On heavy-duty generators, compressors and other high-tension drives no belt can equal Goodyear's new COMPASS Steel Cable transmission belt in power-load capacity.

Built on the time-proved COMPASS principle — *but sinewed with endless multiple-strand steel cables in place of cotton cord* — this new belt is by far the strongest ever developed for service on "killer" drives. It withstands greater shock loads and higher tensions; has a longer flex-life than any multiple ply fabric-bodied belt — and is truly stretchless.

This means troublefree performance on present belt-eating drives. It means you can handle higher peak loads, greater overloads without constant take-ups. And it means new equipment can be set up more compactly on shorter centers. Only Goodyear can offer such a belt because the COMPASS principle is patented by Goodyear, and because Goodyear has the longest successful experience in building steel cable belts.

For complete information on this new Goodyear "first," consult the G.T.M. — Goodyear Technical Man — or write Goodyear, Akron 16, Ohio, or Los Angeles 54, California.

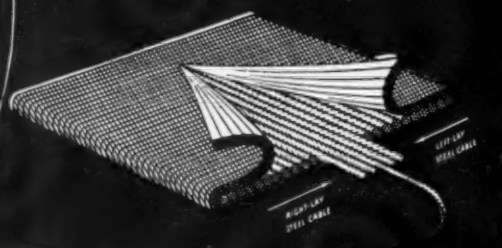
Compass—T.M. The Goodyear Tire & Rubber Company

P.S. Specify Goodyear Compass Cotton Cord belts for regular-duty drives.

FOR HOSE, BELTING, MOLDED GOODS, PACKING AND OTHER INDUSTRIAL RUBBER PRODUCTS built to the world's highest standard, phone your nearest GOODYEAR INDUSTRIAL RUBBER PRODUCTS DISTRIBUTOR.

GOODYEAR INDUSTRIAL RUBBER PRODUCTS

GTM -Specified COMPASS STEEL CABLE TRANSMISSION BELT for Heavy-Duty Drives



The Goodyear Compass Steel Cable belt is bodied with multi-strand airplane-type cable spiralled continuously without a splice. Cable on opposing sides of belt axis is twisted in opposite directions to insure true running.

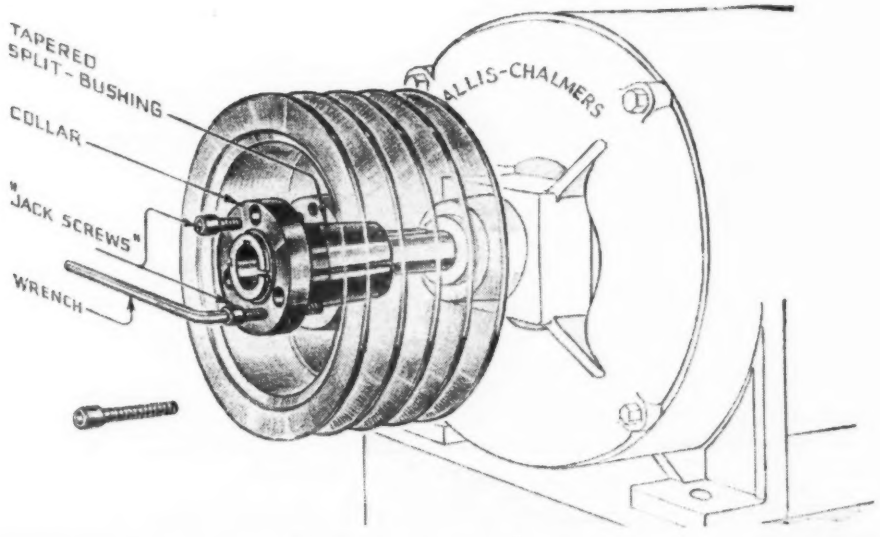
GOODYEAR

THE GREATEST NAME IN RUBBER

A PRODUCT OF GOODYEAR RESEARCH

X-Ray View

OF ALLIS-CHALMERS' NEW "MAGIC-GRIP" SHEAVE



Fastest mounting and demounting sheave on the market, the new "Magic-Grip" costs you nothing extra.

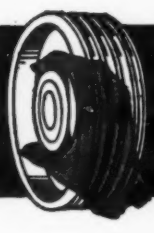
1 Remove three capscrews from bushing collar. A handy wrench — supplied with each sheave — is the only tool needed to remove Allis-Chalmers' new "Magic-Grip" from motor or machine shaft quickly and easily.

2 Insert two capscrews in tapped holes. As screws are turned, they become levers . . . automatically breaking tight grip of tapered split bushing on sheave and shaft. Entire unit is then ready for removal.

3 Remove sheave from shaft. Requires no mallet, no prying, no bulging muscles. You just slide the sheave off . . . smoothly, quickly. *It costs nothing extra!* Send for B6310. Allis-Chalmers, Milwaukee 1, Wis.

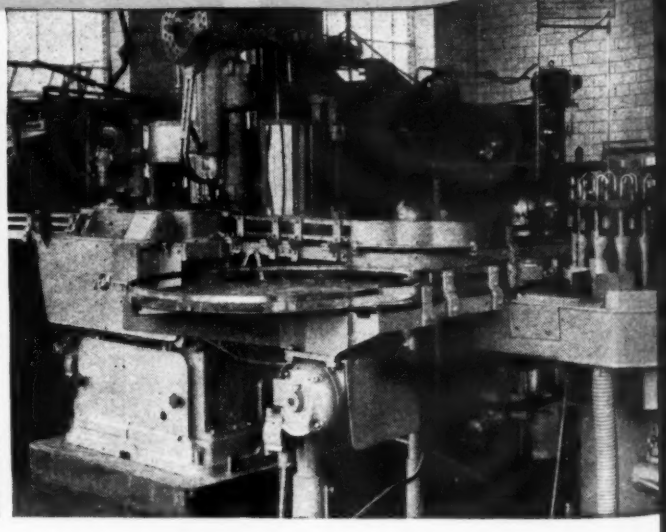
A 1770

Allis-Chalmers Texrope

"MAGIC-GRIP"  **SHEAVES**

STOCK AND SHIPPING ROOM 460 feet long with a 31 foot ceiling is a whale of a heating job—but we licked it with just 8 giant Sturtevant Heaters producing a total of 6,800,000 btu.

Last month we SAVED FUEL for 217 customers like you...



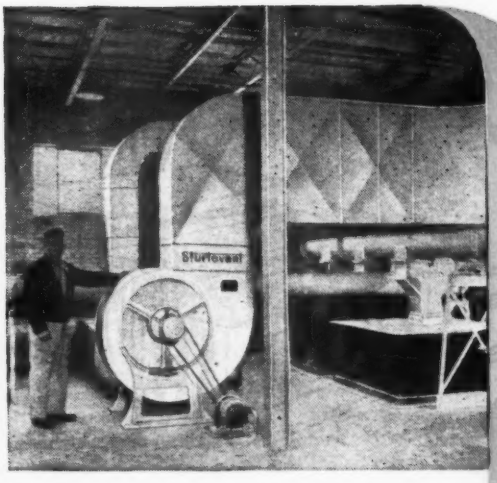
PEPPERELL FABRICS

DYEHOUSE ranges and other vapor-producing processes create a tricky heating problem—that Sturtevant solves—cuts fuel bills in the bargain with a Unit Heater and Vapor Absorption System.

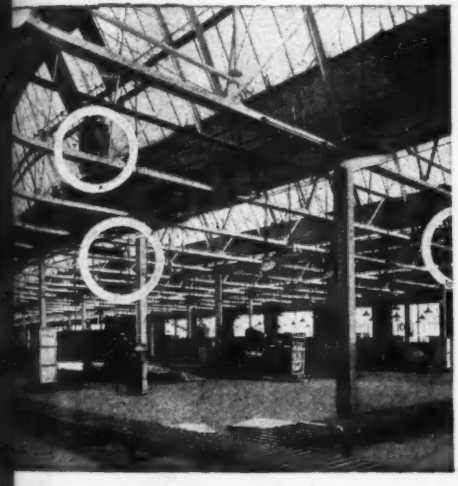
Coca-Cola

BOTTLING PLANT hands the job of heating the entire plant to Speed Heaters — producing *balanced* heat and making every ounce of steam pay off.

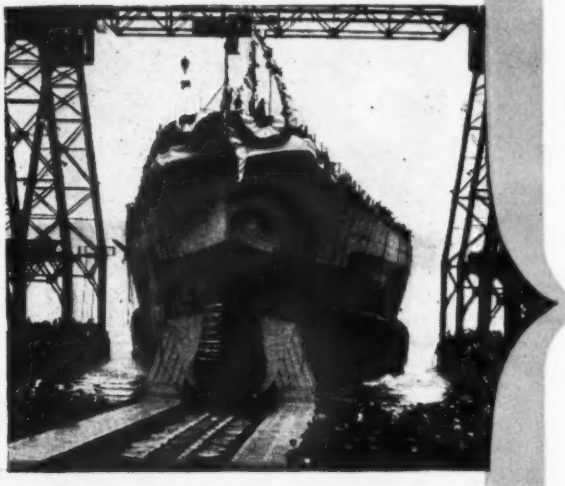
MACHINE SHOP heating job is handled by two large Sturtevant Systems—on opposite walls—special nozzles distribute heat efficiently, fuel costs are minimized.



SEWAGE PLANT calls for a combined heating and ventilating system where recirculated room air is blended in the outside air to minimize heat load.



ASSEMBLY PLANT with high sawtooth roof conserves heat when Speed Heaters are strategically located in accordance with size and shape of the area, proper paths of heat travel.



N. Y. NAVY YARD makes use of almost every type of heating strategy—from a hot blast central system to special portable heaters used during ship construction.

AIR CONDITIONING

DRYING

MECHANICAL DRAFT

VENTILATING

HEATING

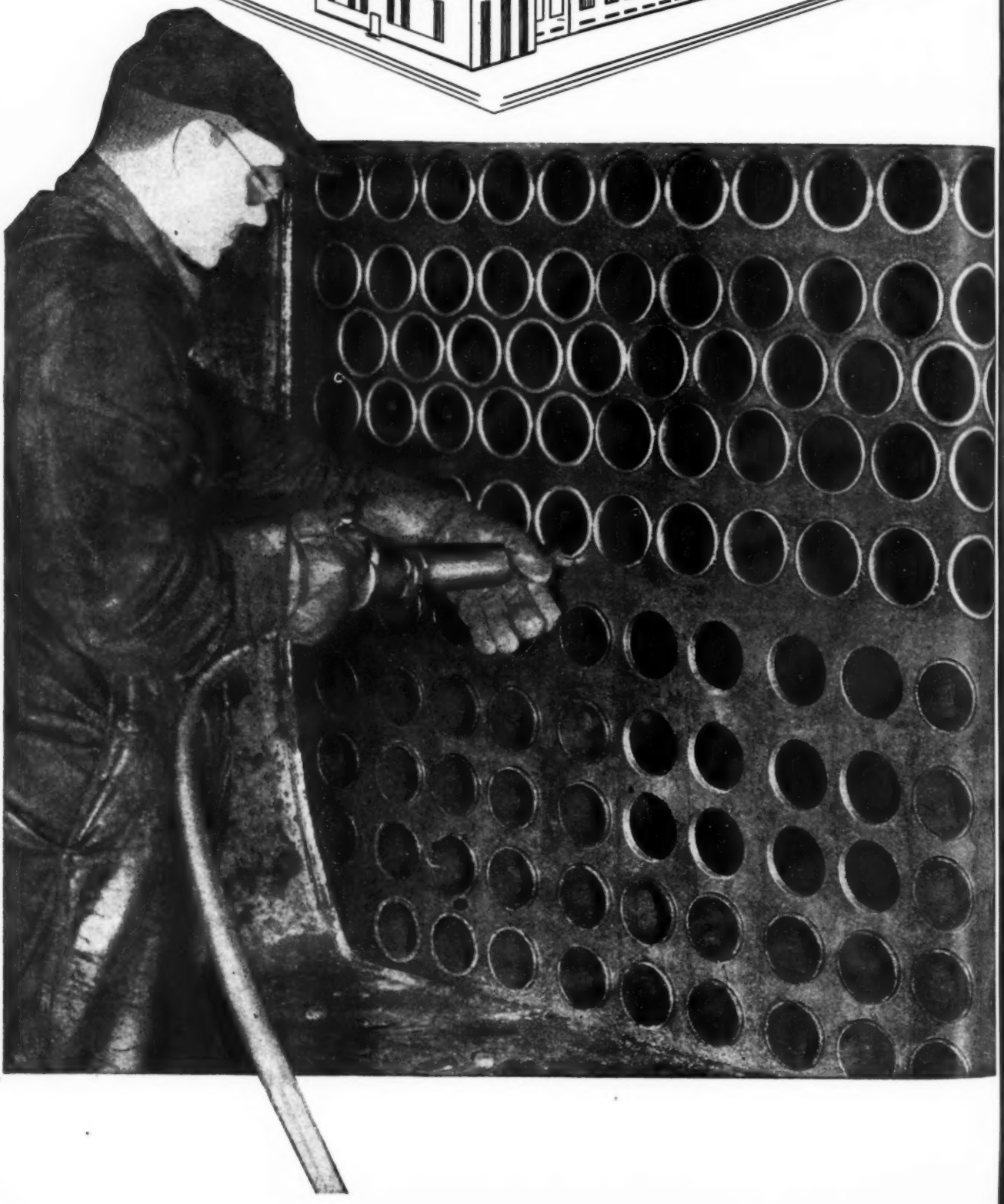
DUST AND FUME CONTROL

The important question to ask about any heating installation is "Will it pay?"... That's why we talk heating with this basic concept in mind — *that every Sturtevant job must profit the user.* No wonder business leaders everywhere call us in on heating problems — and say "ace high" to Sturtevant's economy-minded engineering. Sturtevant makes *all* types of heating units and systems — so we play no favorites. Our advice is always based on what's most economical for you. And Sturtevant is ready now to work with your planning committee to get engineered air recommendations down in black and white — ready for budget approval — and ready for action on conversion day.

B. F. STURTEVANT COMPANY
Hyde Park Boston 36, Mass.

Sturtevant
REG. U. S. PAT. OFF.
Puts Air to Work

GET IT BACK



INTO SERVICE Quickly

WITH REPUBLIC ELECTRUNITE BOILER TUBES

Every day that a boiler is down for retubing, it costs you real money. So get it back into operation in a hurry. And Republic ELECTRUNITE Boiler Tubes will help you.

ELECTRUNITE Tubes slide in freely—because they're uniform in size and diameter. Every ELECTRUNITE Tube rolls in smoothly and beads to a tight joint—because it is full normalized throughout, insuring freedom from hard spots in the metal, and because it is uniform in wall thickness and ductility.

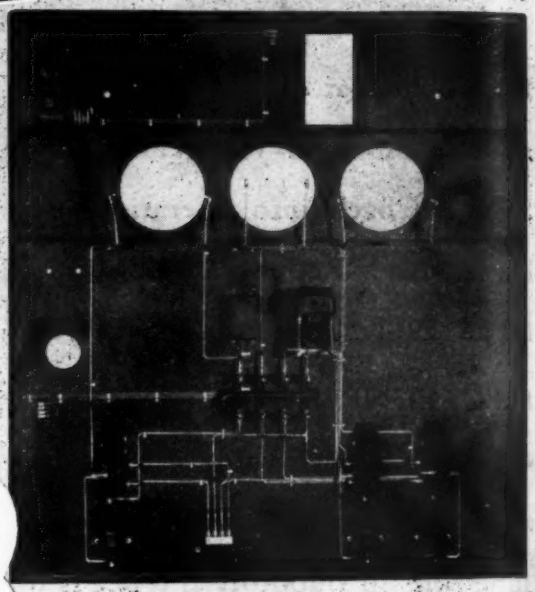
These tubes are free from scale and corrosion-inviting scale pits. They are as clean and free from defects inside as out—because the inside surface is open to inspection before forming into a tube.

Thirteen years of service and more than 120,000,000 feet of ELECTRUNITE Pressure Tubes installed have written the story of their safety and economy on the records of ELECTRUNITE USERS. They can do the same for you—and we're ready to tell you how.

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO
Export Department: Chrysler Building, New York 17, New York

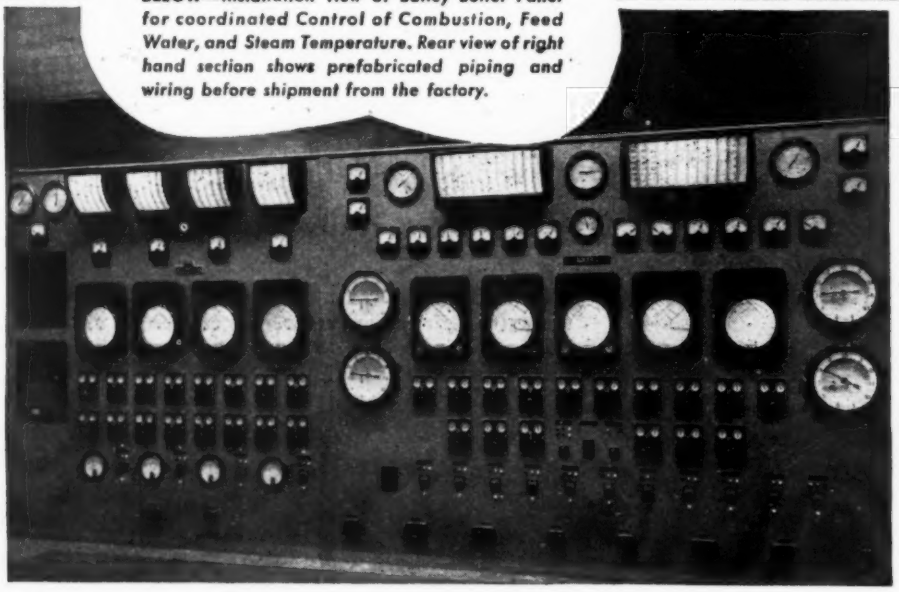
Republic
ELECTRUNITE
BOILER, CONDENSER AND
HEAT EXCHANGER TUBES

SIMPLIFY BOILER CONTROL INSTALLATION



ABOVE—*Prefabricated Bailey Boiler Control Panel as installed aboard a vessel of the Merchant Marine, and as piped and wired ready for shipment from the factory.*

BELOW—*Installation view of Bailey Boiler Panel for coordinated Control of Combustion, Feed Water, and Steam Temperature. Rear view of right hand section shows prefabricated piping and wiring before shipment from the factory.*



BAILEY METER CONTROL

BOILER METERS • MULTI-POINTER GAGES • FLUID METERS • RECORDERS • SUPERHE

PREFABRICATED BAILEY CONTROL PANELS

Cut Installation Time, Forestall Piping and Wiring Errors, Insure Use of Suitable Materials, Present Finished Appearance, Reduce Total Cost, and Simplify Field Engineering . . .

★ Prefabricated Bailey Control Panels are welcome equipment to the erection crew and to the engineers responsible for installation.

Each panel comes neatly wired and piped with all connections thoroughly checked by trained instrument mechanics. Small units such as switches, signals, valves and relays are mounted and connected ready for action. Cut-outs, drilling, and all necessary connections are provided for meters which must be shipped unmounted. These are mounted after the panel is secured in its final location.

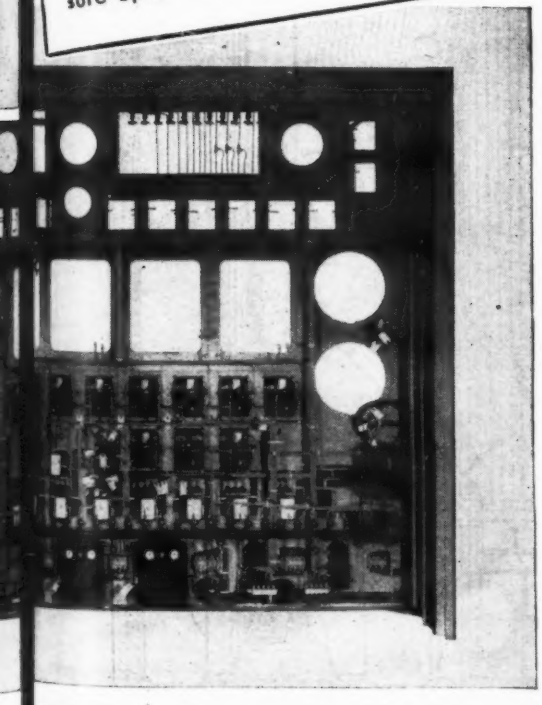
Prefabricated Bailey Control Panels may include not only interconnecting air-operated control piping, but instrument connections, and electrical wiring as well if desired. The installation of all this wiring and piping at the same time according to a coordinated plan insures a neat appearing finished product with an orderly arrangement of all connections.

Instrument piping, outgoing air-control lines and electric wires are attached to convenient terminals and tagged to insure proper connections.

The Bailey Engineer in your community will be glad to help you apply the time and money saving features of prefabricated control panels to the particular requirements of your plans for new construction or modernization.

FOR COORDINATED BOILER CONTROL

Prefabricated Bailey Boiler Control Panels simplify the coordination of combustion, feed water, steam temperature, heater levels, pump speeds and other related factors which all must be in balance to insure optimum boiler performance.



A-91

BAILEY METER COMPANY

1036 IVANHOE ROAD • CLEVELAND 10, OHIO

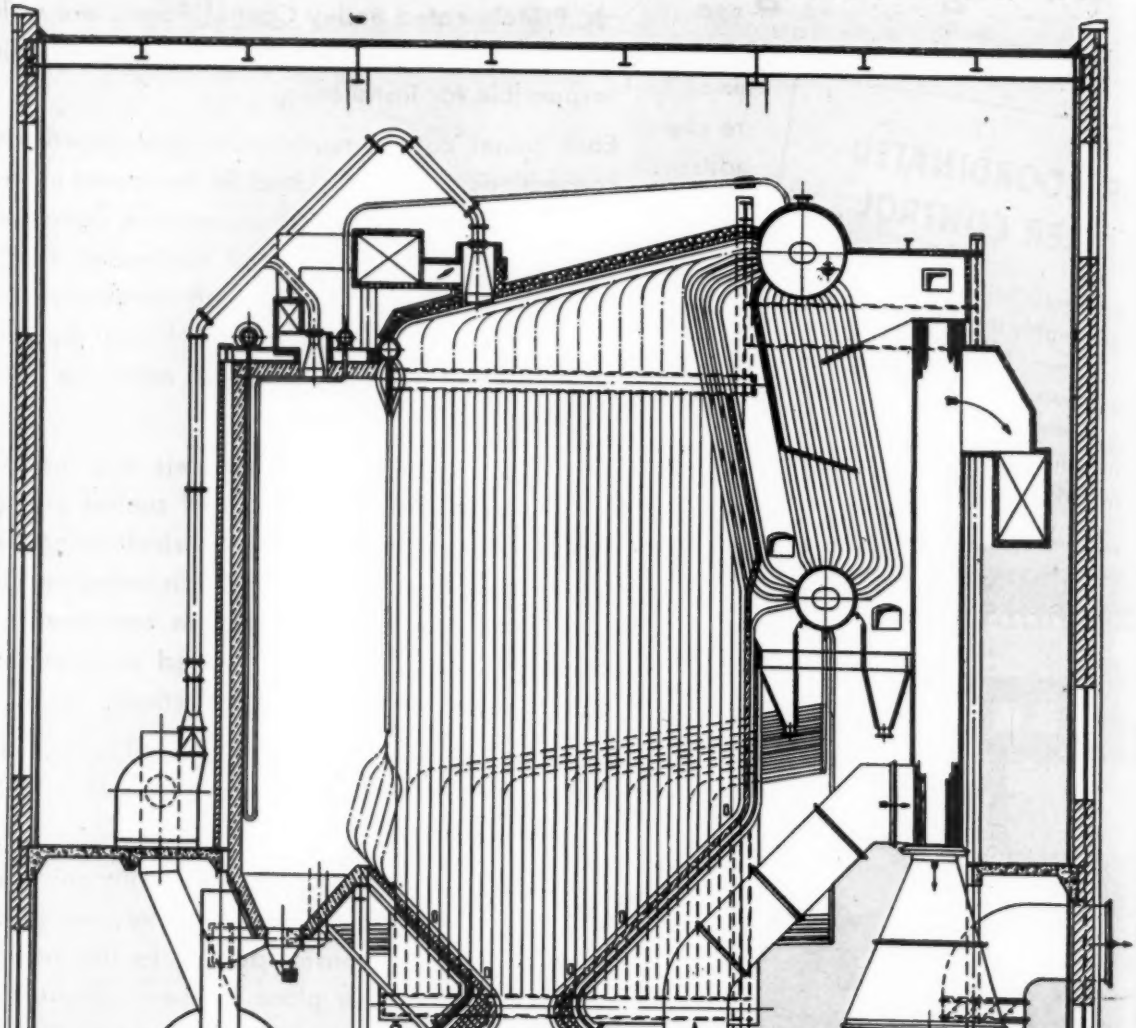
Bailey Meter Company Limited, Montreal, Canada

. . . The Complete Boiler Control System

TROL • DESUPERHEAT CONTROL • COMBUSTION CONTROL • FEED WATER CONTROL

KVS ENGINEERING

anticipates tomorrow's needs



for ECONOMY... HIGH EFFICIENCY AND... LOW MAINTENANCE

MODERN features of this complete, pulverized coal-fired steam-generating unit have been engineered by KVS to achieve over-all high efficiency on a wide range of coals and to assure close temperature control under practically all load conditions.

Accurate control of superheat and total steam temperature is provided by locating the superheater in a separate furnace fired by an individual burner. Varying heat output of this burner places in the operator's hands effective means of regulating steam temperature at any steam flow. Automatic regulation of fuel and air to burner makes possible the maintenance of uniform steam temperature over any range of load and under any load variation.

Proper coal pulverization for the combustion requirements involved in this design, is assured through the use of the Kennedy Air-Swept Tube Mill Pulverizer which provides a continuous, dependable supply of superfine pulverized coal regardless of the quality of coal available, and at lowest cost per ton of coal handled.

Units of this type can be furnished for any capacities, pressures or temperatures and are recommended for use with bituminous coals.

KVS PRODUCTS

Boilers
Air-Swept Tube Mill Pulverizers
Fans
Air Preheaters
Superheaters
Economizers
Water Walls
Coal Elevators
Bunkers
Coal-Weighing Scales
Ash Conveyors

●

KVS ENGINEERING

Kennedy Van Saun offers a complete service for the design, building and furnishing complete, ready-to-operate steam generating plants including all necessary components. This service is available under one responsibility. Your steam requirements will have the prompt, careful attention of KVS Engineers.

Kennedy Products

Kennedy-Van Saun

MANUFACTURING AND ENGINEERING CORPORATION

2 PARK AVENUE • NEW YORK 16, N. Y.

FACTORIES: DANVILLE, PA.

CANADA • ENGLAND • AUSTRALIA

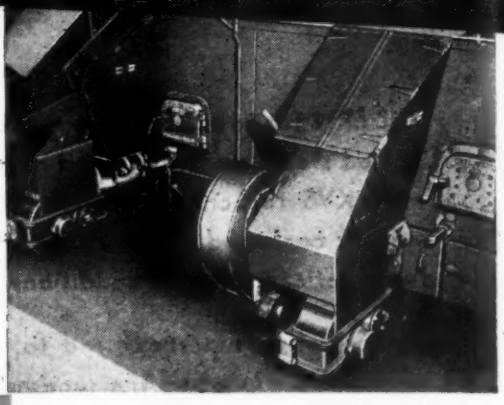
ARMY E NAVY

CANTON STOKERS *meet* TODAY'S . . .

MORE STEAM . . .

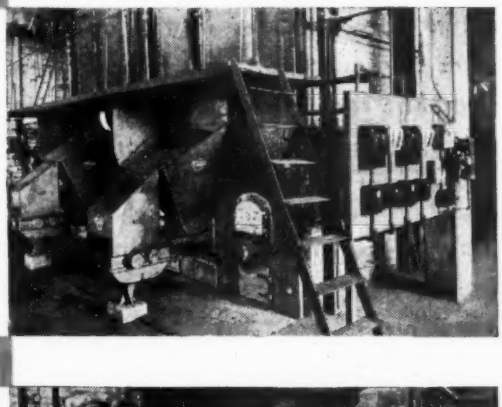
SAVING HUNDREDS OF DOLLARS ANNUALLY ON COAL ALONE

At Grove Park Inn, Asheville, N. Carolina, Canton Lo-Set Ramfeeds replaced another well known make Ramfeed Stoker, saving almost 50% of previous fuel bill, as Mr. Roberts, Chief Engineer, reports. The savings resulted not only because more efficient stokers were installed, but also because Canton helped re-engineer steam production and use in entire plant — another valuable Canton service.



INCREASED STEAM OUTPUT OVER 50% WITH SAME BOILER

A detailed view of two Canton Vulcan Ramfeed Stokers showing the Synchronized Combustion Control panel at right. This large Eastern rendering plant, Norton and Company, Alexandria, Virginia, requires a maximum output of steam—depends on Canton Stoker firing to deliver 200% of the boiler rating. Cantons furnish steam at constant pressures, at the same time saving over 25% in fuel costs.



HIGHEST OPERATING EFFICIENCY WITH LOWEST MAINTENANCE COST

The E. & W. Dyeing Corporation, Paterson, N. J., require a huge volume of steam for their processing and heating operations. With increasing demand upon the two 250 H. P. boilers formerly oil fired, the change-over to coal firing with Cantons made possible efficient operation at 200% of rating and easily met the higher demand for steam. Mr. R. Ullnick, Purchasing Agent for E. & W., reports "completely satisfactory service from the two Vulcan Ramfeed Cantons with no repairs necessary since installation." Another example of Canton's dependable service and worthwhile savings.

CANTON . . . *the* ONLY STOKER *Guaranteed* 5 YEARS

Canton buyers receive this added Bond of Insurance against DEFECTS—and even WEAR itself. This is the best reflection of Canton in-built ruggedness and durability that means long stoker life and dependable operation.

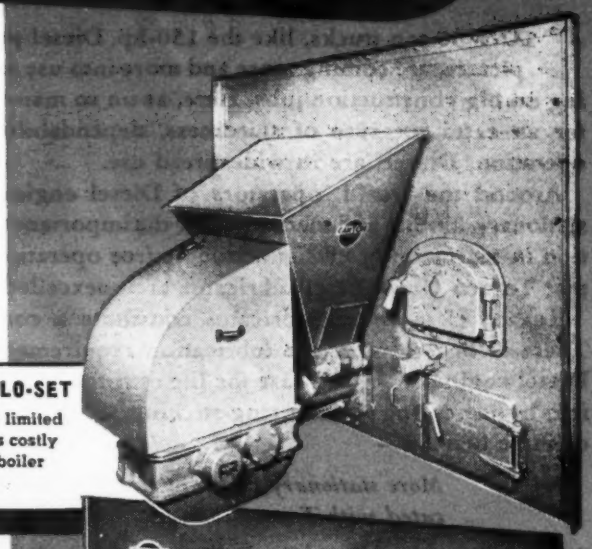
. . . *and* TOMORROW'S NEEDS

CANTON STOKERS

. . . *from* LESS COAL

FUEL AND MANPOWER SAVINGS MORE THAN PAY FOR CANTON INSTALLATIONS

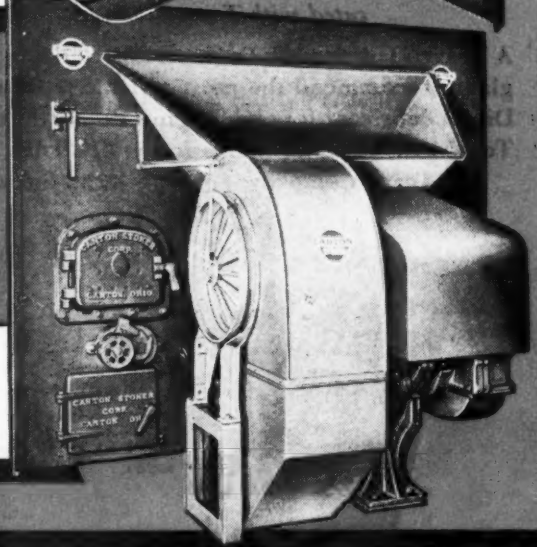
Fuel burning efficiency has never been more important than in the present emergency. Hundreds of Canton Stoker installations are making new records for saving fuel and manpower . . . keeping maintenance costs low. Canton Stoker's cooperative engineering, proper installation and trouble-free performance enable you to count on fuel and manpower savings that make the investment quickly self-liquidating.



CANTON LO-SET
Designed for limited space. Saves costly pitting and boiler changes.

54 TYPES AND SIZES OF CANTONS TO MEET EVERY NEED up to 800 H. P.

Every Canton Stoker installation is engineered for the specific job. The completeness of type and size range (with Canton's dependable Synchronized Combustion Controls) assures successful, economical performance. After thorough analysis of your needs by Canton engineers, you select the Canton model that will certainly meet all requirements.



CANTON VULCAN
Rugged ramfeed construction carries heaviest industrial loads continuously.

CANTON STOKER CORPORATION

741 ANDREW PLACE, S. W., CANTON, OHIO

SEND FOR COMPLETE FACTS NOW

Gentlemen:

---Please send all descriptive literature at once

---Have a CANTON Engineer interview us immediately

Name _____

Company _____

Address _____

City _____ State _____

Informative bulletins are available for detailed information on all Canton Stoker models. Our staff of Field Engineers is at your service for Free Consultation on Combustion Problems. Use the coupon or write, wire or phone us today.

DIESELS

FOR THE BIG JOBS

GIANT 30-ton trucks, like the 150-hp. Diesel-powered Mack in the picture, are coming more and more into use for off-highway hauling on big construction jobs. Here, as on so many other jobs that call for an extra measure of sturdiness, dependability and economy of operation, Diesels are in widespread use.

Around the world, operators of Diesel engines large and small, stationary, mobile and marine, know the importance of effective lubrication in maintaining efficient, trouble-free operation. They know, too, that Texaco Ursa Diesel lubricants are unexcelled in assuring this.

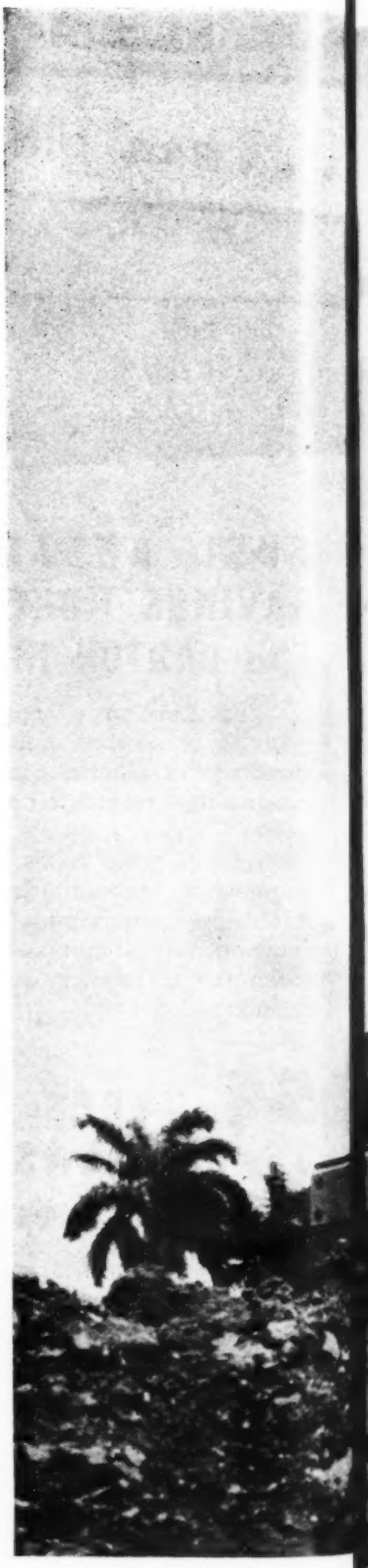
Texaco Ursa Diesel lubricants constitute a complete line of oils. There is one to meet the lubrication requirements of every type of Diesel engine. They increase the life of rings, pistons, liners and bearings by preventing scuffing, ring-sticking, sludge and corrosion. Because of these benefits—

More stationary Diesel hp. in the U. S. is lubricated with Texaco than with any other brand.

A Texaco Lubrication Engineer, specializing in Diesel lubrication, will gladly recommend the most suitable type and grade of Texaco Ursa Diesel lubricant for your engine. Phone the nearest of more than 2300 Texaco distributing plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

FREE: "Diesel Operation"—fully illustrated, 112-page book of facts and figures. Shows simply and clearly relation of fuel and lubricants to operating efficiency of Diesel engines. Write for your copy today.



TUNE IN THE TEXACO STAR THEATRE WITH JAMES MELTON EVERY SUNDAY NIGHT CBS

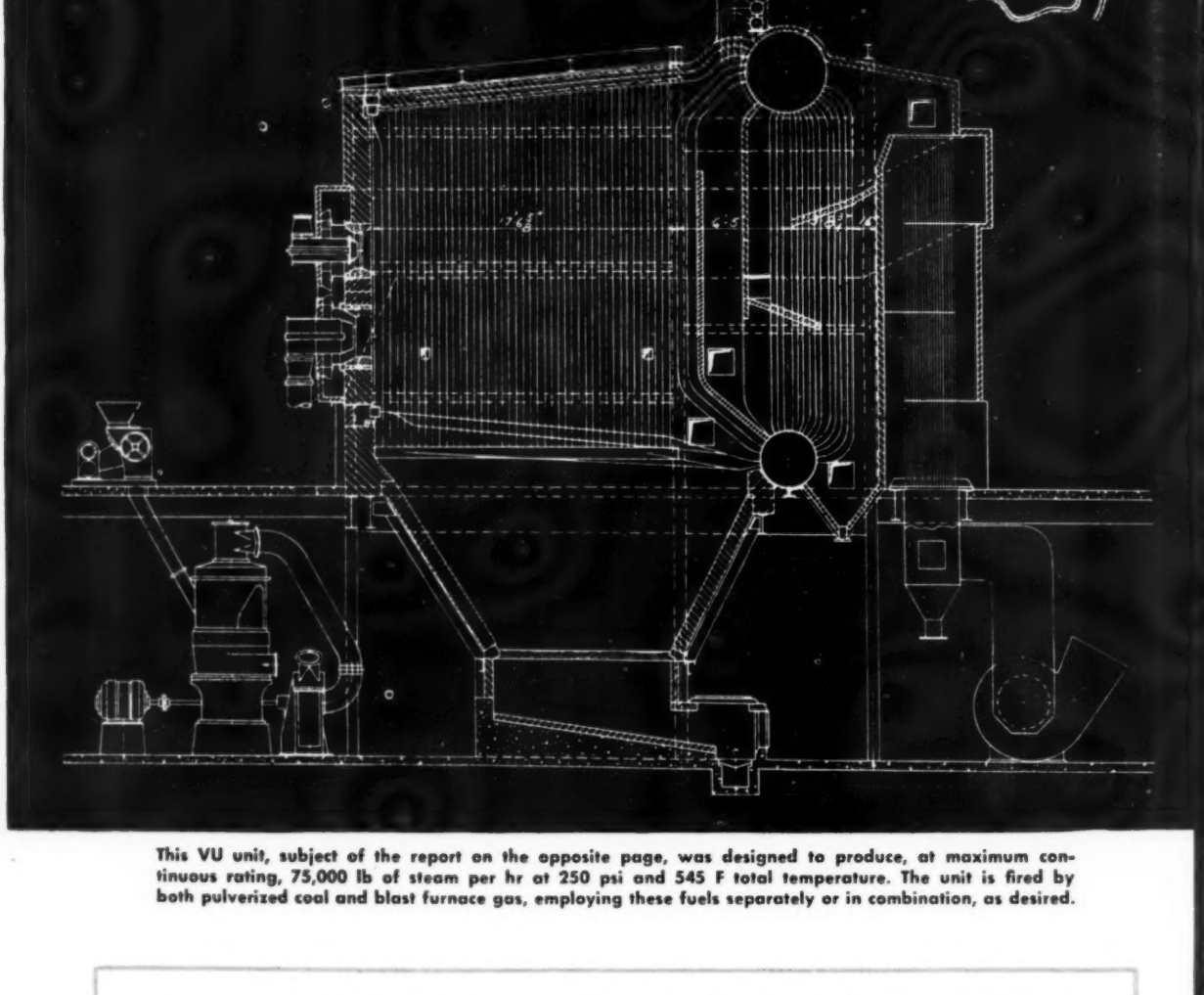
TEXACO

TEXACO

Lubricants and Fuels

FOR ALL DIESEL ENGINES

AN INSIDE STORY



This VU unit, subject of the report on the opposite page, was designed to produce, at maximum continuous rating, 75,000 lb of steam per hr at 250 psi and 545 F total temperature. The unit is fired by both pulverized coal and blast furnace gas, employing these fuels separately or in combination, as desired.

VU Units meet a wide range of requirements

VU Steam Generators are in service for capacities ranging from 20,000 lb to 300,000 lb of steam per hour; design pressures up to 1,000 psi; total temperatures as high as 915 F. Designed for firing with pulverized coal, oil, gas or combinations of these fuels; also adaptable to all types of stokers.

C-E

COMBUSTION

OF VU PERFORMANCE

FIELD REPORT ON ANOTHER C-E INSTALLATION

The evidence left inside a boiler after long, continuous operation tells a significant story. Here is the inside record of a C-E Steam Generator, Type VU, shown on the opposite page, in one of the plants of a large Pittsburgh chemical company. *Eleven months* after its installation this unit was shut down for the *first* time, and then only for State and insurance inspection. The inspection showed:

1. A constant water line across full width of drum; variation of only 1 to 2″ from normal water level.
2. A light, easily-washed-off phosphate coating on drum, steam washer and boiler tubes.
3. Slight deposits in water wall tubes and headers. No turbining required.
4. Light ash deposits on furnace walls. Tubes, fins and exposed refractory in excellent condition.
5. Soot blowers and baffles in fine condition. All boiler passes clean.
6. Normal, moderate wear of Bowl Mill. Exhauster blades and liners replaced although still good for additional service.

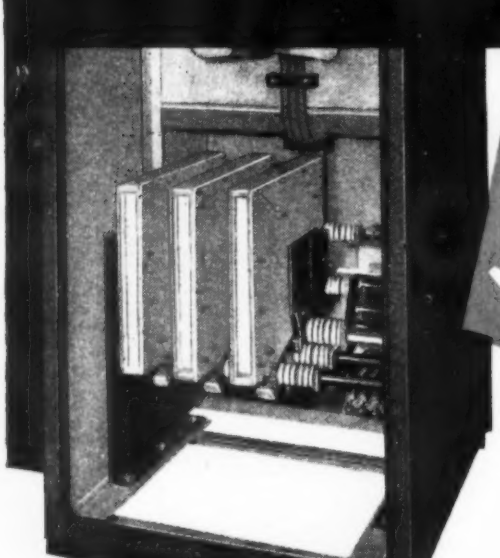
That is the inside story of a VU Steam Generator. During 11 months of continuous service, operating with 100% feedwater makeup, it produced 402,244,000 lbs of steam at an average rate of 50,000 lb per hr every hour of the entire period. It tells why these C-E Units can be depended upon for a notably high use factor and low maintenance. No user can get more out of a boiler than its manufacturer puts into it, and the foregoing evidence that these desirable qualities are virtually built into VU Boilers is further substantiated by the long and excellent performance records of hundreds of VU installations in all types of industry throughout the country. A-862

ENGINEERING

200 MADISON AVENUE, NEW YORK 16, N. Y.

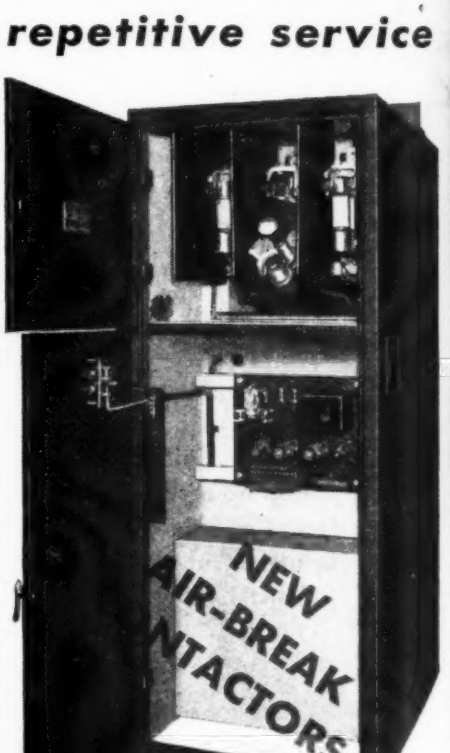
C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

Why LIMITAMP CONTROL is good for MILLIONS of operations



NEW AIR-BREAK CONTACTORS

Daily demonstrating their remarkable stamina in severe repetitive service



THESE new contactors meet the most severe requirements of high-voltage motor-control service. Their design gives them a mechanical life of millions of operations. Contact-tip life of many times the life of comparable oil-immersed tips makes these air-break contactors the logical answer for any severe duty—in steel mills, rubber mills, etc. The current-limiting fuses, Type EJ-2, are an especially important feature. They operate in a split cycle. When a short occurs, they cut off the rise in current in less than a quarter cycle, and clear it in less than a half cycle—long before the short has had time to harm the contactor or motor.

Here are 3 other important advantages

1. *Personnel protection*—Totally metal-enclosed, Limitamp controls give protection to operating personnel.

2. *Overload protection*—Isothermic overload relays, calibrated accurately against actual motor characteristics, protect the motor from overheating due to sustained overloads or single-phasing.

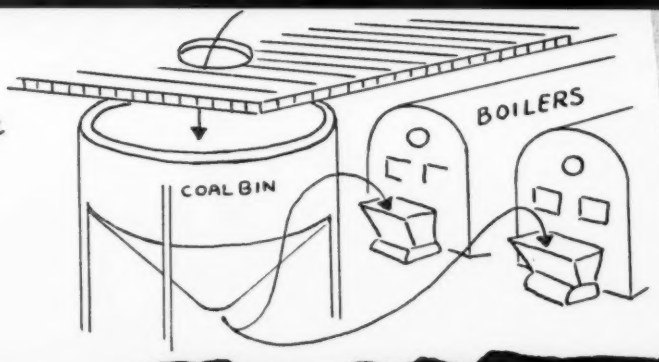
3. *Undervoltage protection*—All Limitamp controllers can be furnished with instantaneous or time-delay undervoltage protection.

YOU'LL WANT TO KNOW all about this motor control. How separate compartments for the high- and low-voltage circuits protect the operator. How a group of these starters can be fitted together to give you a neat, compact control panel. Our local sales engineers will be glad to help you select a control to fit your application. ***General Electric Company, Schenectady 5, N. Y.***

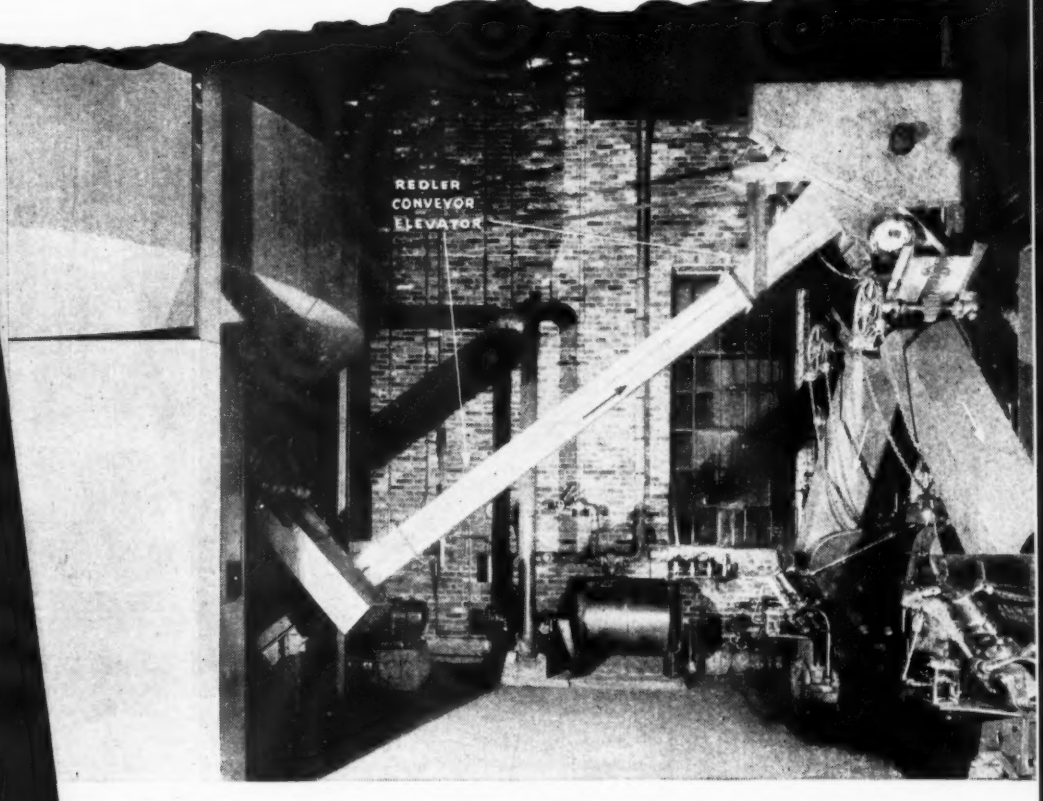
Buy all the BONDS you can—and keep all you buy

GENERAL ELECTRIC — **INDUSTRIAL CONTROL**

The Problem—
To install a coal conveying system to fit cramped quarters of small boiler room and keep room clean—



HOW S-A ENGINEERS "Killed Both Birds with One Stone"



REDLER shown elevating coal from cylindrical bin to point in front of stoker hoppers where two-way spout regulated by S-A Rack and Pinion Gates distributes required amount of coal to each stoker.

In these cramped quarters, compactness of coal conveying equipment was essential and an S-A REDLER Conveyor-Elevator, requiring a very minimum of space compared to conventional conveyor types, was the answer. Coal is conveyed from bin to *two* stoker hoppers with sealed REDLER casings preventing the escape of coal dust into the boiler room.

When handling problems are made more complicated by local conditions . . . such as the close quarters in this boiler room . . . access to the *right equipment installed right* pays extra dividends. Write for information on a modern REDLER Coal Handling system for your plant.

STEPHEN S-A ADAMSON MFG. CO.

RIDGEWAY AVENUE, AURORA, ILLINOIS — LOS ANGELES, CALIF. ★ BELLEVILLE, ONT.

Designers and Manufacturers of All Types of
BULK MATERIAL HANDLING EQUIPMENT

COMPACT, self-contained G-E unit substations are "strong points" of modern power distribution

It seems incredible. But the fact is that each of the two factory-built G-E unit substations you see above handle one-third *more* power than the entire conventional (gingerbread) layout at the top of the opposite page. They do it with lower electrical losses, and afford greater protection for personnel. Installed as a part of a well-planned, modern power-distribution *system,* they help to assure greater continuity of power to every point of use.

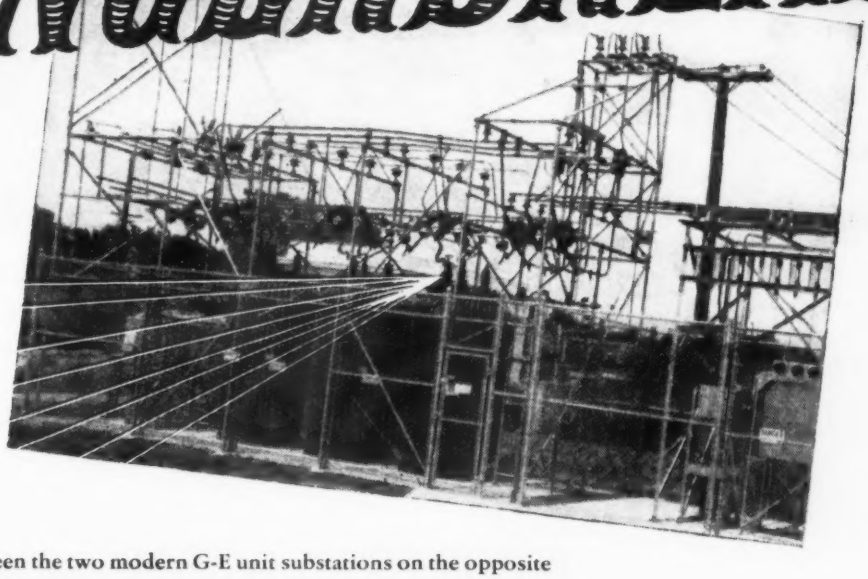
G-E unit substations practically eliminate the manpower problems of assembly on the job. They come ready to connect, combining the necessary transforming capacity, cable-termination facilities, and high-voltage and low-voltage switchgear. The transformer section of each unit is sealed against dirt and dampness. With Pyranol*, which can't burn, these substations can go anywhere, outside or indoors. The metal-clad switchgear isolates each circuit and circuit breaker in a separate, grounded compartment. Vertical-lift breakers have interrupting capacity fully adequate for any emergency.

A plant power system that combines several unit substations close to the load centers is highly flexible. Increased loads can be met, step by step, with duplicate units. And war-plant records of "unit subs" in service show unusual savings in maintenance and manhours. Ask your G-E representative for the story. *General Electric Company, Schenectady 5, New York.*

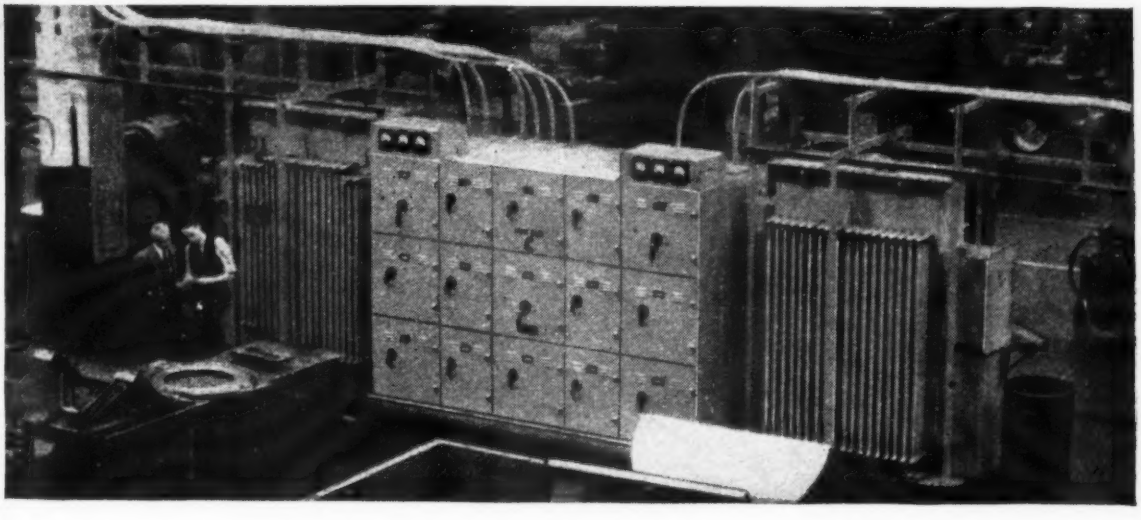
*Trade-mark Reg. U.S. Pat. Off.

Buy all the BONDS you can—*and keep all you buy*

to GINGERBREAD



WHAT A CONTRAST between the two modern G-E unit substations on the opposite page, which serve nine 300-hp pump motors, and the layout above, which serves only three 500-hp pump motors. Yet even the gingerbread substation above affords better protection than many old-time "briar-patch" installations still in service.



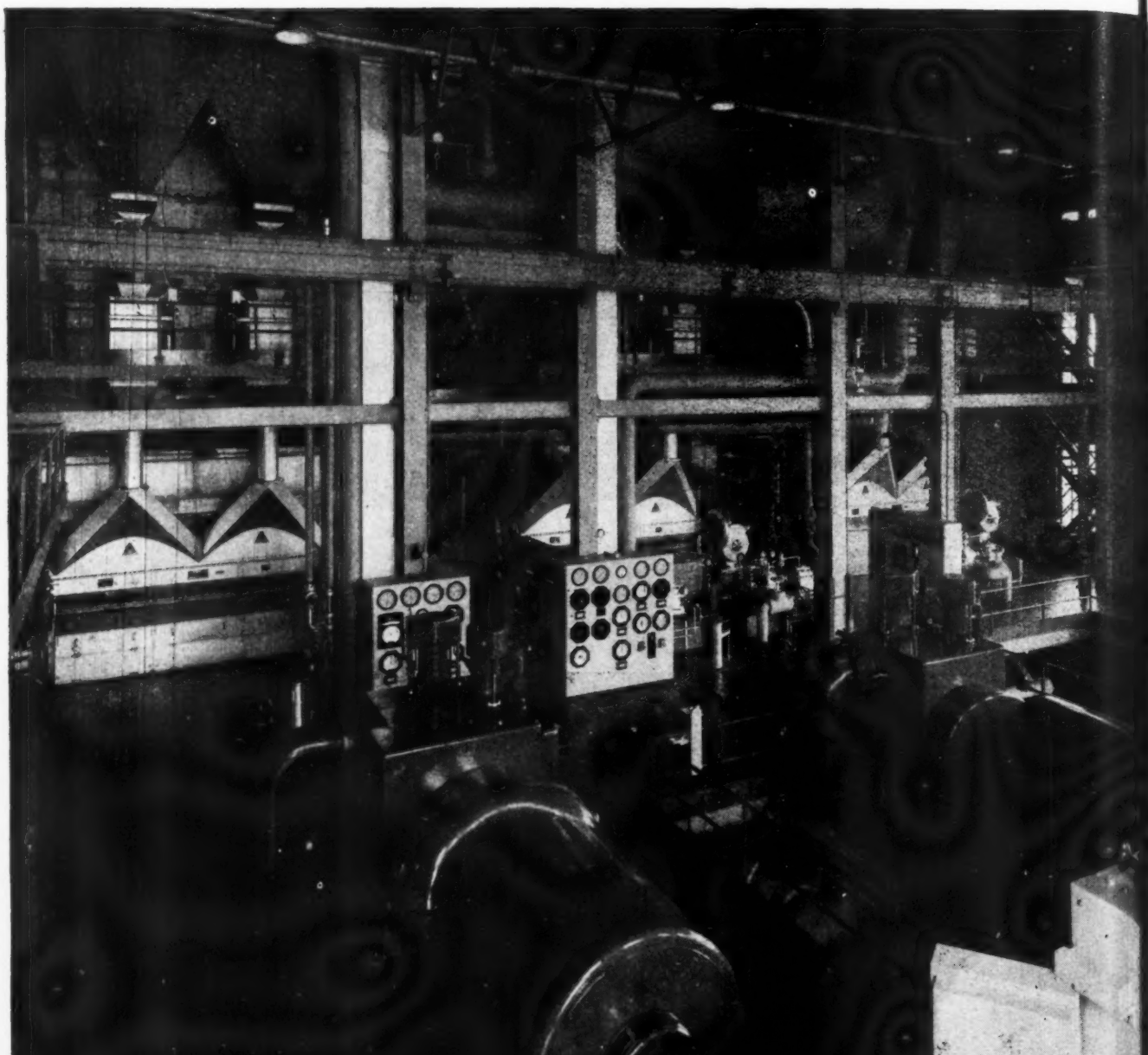
INDOORS, EVEN MORE ADVANTAGES are made possible by G-E unit substations combined in a co-ordinated, load-center distribution system. They can be placed in factory work-areas, thus keeping short the heavy-copper secondary circuits, and overcoming voltage-drop problems economically. Unlike open switchboards and oil-cooled transformers, they need no isolation wards indoors.

LOAD-CENTER POWER DISTRIBUTION SYSTEMS

GENERAL ELECTRIC

302-38-5900

Specify Republi



A Republic combustion control system operates the three boilers in this new power plant which supplies all the steam and power for a large university. During the first year of operation this new plant provided heat for
percent more building space, generated 114.3 per
more electric power but consumed 9.86 percent less f

REPUBLIC
INSTRUMENTS
AND CONTROLS

Combustion Control

TO INCREASE TODAY'S STEAM PRODUCTION

TO DECREASE TOMORROW'S STEAM COST

The installation of Republic automatic controls on your boiler (or boilers) will enable you to:—

SAVE FUEL by automatically maintaining highest combustion efficiency.

INCREASE STEAM OUTPUT by operating the boilers at test efficiency 24 hr. a day, 7 days a week.

CONSERVE MANPOWER by automatically performing the many routine repetitive adjustments.

REDUCE OUTAGES by maintaining uniform operating conditions and thereby prevent the chain-of-event type of trouble that frequently developes as a result of incorrect boiler operation.

An automatic combustion control system, as designed and built by Republic, will help you meet today's need for more steam and tomorrow's need for lower steam costs.

The Republic combustion control is a unified system controlling simultaneously, in measured quantities and in correct proportions, the fuel and air input to the boiler. It increases or decreases the fuel and air supply to the boiler in the correct amount to maintain constant steam pressure and in the correct ratio to maintain maximum combustion efficiency. It not only checks operation but automatically makes necessary corrections of individual factors before faulty operation has a chance to develop.

The difference between such a control and an assembly of uncoordinated regulating devices is comparatively small in equipment but great in principle. Merely to provide automatic operation of a number of individual device is not enough.

CHECK THESE FEATURES

Built into the Republic combustion control systems are many features that enable it to fulfill all the conditions of theoretically perfect combustion control and still meet all the demands of everyday operation.

Check the following features against your list of "musts" for a perfect combustion control system.

CENTRALIZED CONTROL: The operation and control of the boiler or boilers is centralized at the master controller.

FUEL-AIR RATIO INDICATOR: The master controller is provided with mercury manometers which indicate the measured fuel and air inputs to the boiler and the fuel-air ratio.

FUEL-AIR RATIO ADJUSTMENT: A handwheel on the front of the master control panel provides a convenient means for adjusting the fuel-air ratio.

ALL BOILER RATINGS: Maintains proper fuel-air ratio over the entire range of boiler ratings.

CONSTANT STEAM PRESSURE: Maintains the plant steam pressure within narrow limits of variation by proportioning the fuel and air inputs to the load.

LOAD DISTRIBUTION: Provides a means of distributing the load among the boilers as desired.

MANUAL CONTROL: Boiler ratings can be controlled manually by a handwheel located on the front of the panel.

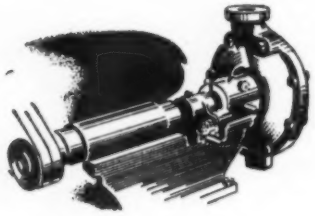
Find out about Republic control systems. One of our engineers will be glad to consult with you at any time. Write us today.

Republic Flow Meters Co.

2240 Diversey Parkway · Chicago 47, Illinois

For the Tough Jobs use

Properties of HAYNES STELLITE Alloys	Average Tensile Strength, psi	Average Hardness, Rockwell	Melting Point, Deg. F	Can be Forged	Can be Rolled
HAYNES STELLITE Cobalt-Base Alloys					
1	47,000	C54	2,282	No	No
6 Cast	105,000	C40	2,327	Yes	Yes
Rolled	130,000	C40 to C46			
12	76,000	C48	2,306	No	No
Star J-Metal	65,000	C61	2,318	No	No
98M2	63,000	C62	2,250	No	No
HASTELLOY Nickel-Base Alloys					
B Cast	80,000	B96	2,440	Yes	Yes
Rolled	135,000	B98			
C Cast	76,000	B93	2,350	No	Yes
Rolled	120,000	B90			
D Cast	38,000	C53	2,040	No	No
HAYSTELLITE Tungsten-Base Alloys	—	Between 9 and 10 Moh's Scale	—	No	No
HASCROME Iron-Base Rod	40,000	C40-50 after peening	—	Yes	Yes



Castings . . . A wide range of castings can be supplied in:
- HAYNES STELLITE Alloys 6, Star J-Metal, 98M2, 93
- HASTELLOY Alloys B, C, D
- HAYSTELLITE Tungsten-Base Alloys

Rolled Forms . . . Sheets and plates are made from:
- HAYNES STELLITE Alloy 6
- HASTELLOY Alloys B, C

Hot-rolled bars are supplied in:
- HASTELLOY Alloy B

Welding Rods . . . for applying a wear- and corrosion-resistant alloy coating to other metals:
- HAYNES STELLITE Alloys 1, 6, 12
- HASTELLOY Alloys B, C, D
- HAYSTELLITE Alloys
- HASCROME Rod

HAYNES STELLITE Alloys

Resistance to Corrosion		
Oxidation at High Temp.	Sulphuric Acid	Hydrochloric Acid
Excellent	Fair	Fair
Excellent	Fair	Fair
Excellent	Fair	Fair
Excellent	Fair	Fair
Excellent	Fair	Fair
Fair	Good	Excellent
Excellent	Good	Good
Fair	Excellent	Fair
—	—	—
Fair	—	—

Available in a wide range of properties and forms to resist wear, corrosion, and heat . . .

HAYNES STELLITE alloys are specially made to meet the requirements of industry's most difficult applications. They are hard, tough, and heat-resistant and are used for those parts of equipment and machines that are most subject to wear and corrosion. The chart at the left describes some of these alloys and their significant properties. Sketched below are some of the forms in which they can be furnished.

For further information, write for the booklet, "Properties of HAYNES STELLITE Alloys."

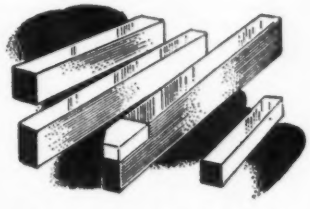
HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

UCC

General Office and Works, Kokomo, Ind.

Chicago—Cleveland—Detroit—Houston—Los Angeles—New York—San Francisco—Tulsa



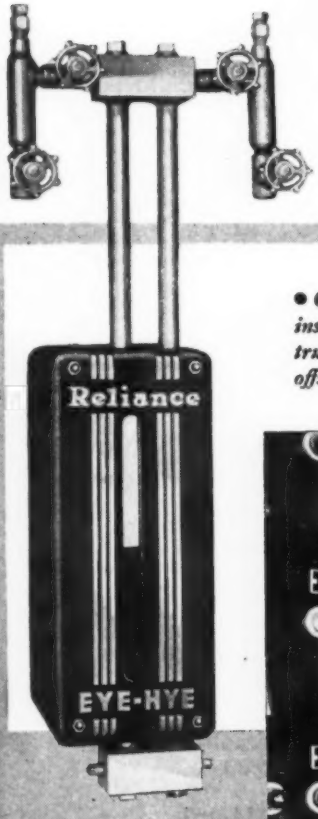
Metal-Cutting Tools . . . **made from HAYNES STELLITE Alloys, known for their red hardness. These tools take heavy cuts at high speeds and coarse feeds—with long life between grinds:**

HAYNES STELLITE Star J-Metal
HAYNES STELLITE Alloy 98M2

HAYNES STELLITE . . . HASTELLOY . . . HAYNES STELLITE . . . HASTROMET are registered trade-marks of Haynes Stellite Company

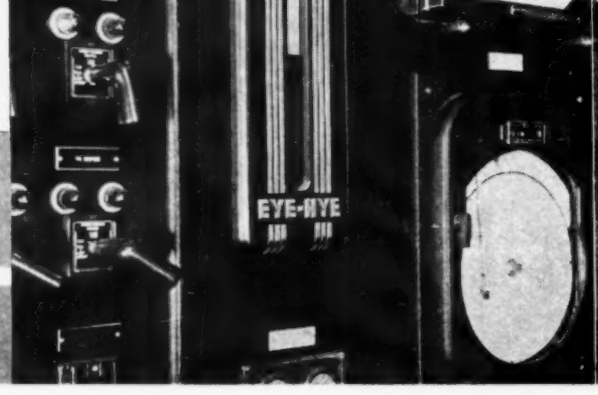
BUY UNITED STATES WAR BONDS AND STAMPS

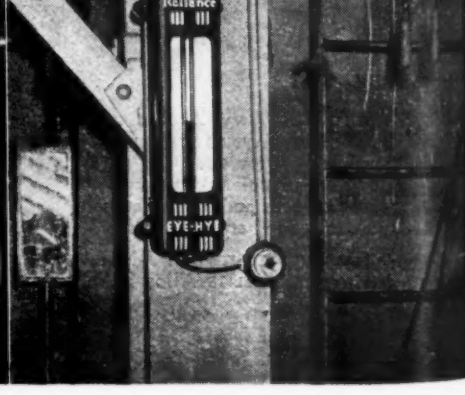
The Simplicity



• *On the panel board, EYE-HYE takes its place with instruments. The face plate mounts on the front, protruding only three-quarters of an inch. Tubes may be offset to clear other instrument mechanisms in the rear.*

• *EYE-HYE may be mounted on a wall or girde on a specially constructed stand or panel, if not pl on the main instrument board. It is usually hung its window about five feet from the floor.*





f EYE-HYE is the Secret of its Dependable Accuracy

THE ALL-HYDROSTATIC, REMOTE-READING WATER LEVEL INDICATOR

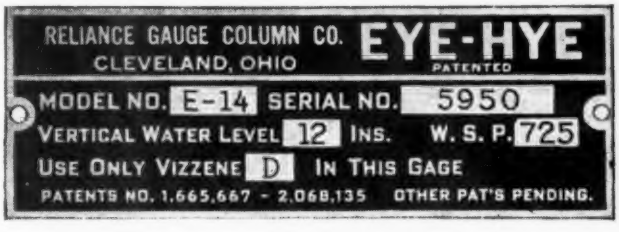
• EYE-HYE works on a basic law of physics that all engineers understand—the hydrostatic U-tube. Simply a glass of water and a few ounces of Vizzene* in a manometer of sturdy design, EYE-HYE gives you the dependable accurate indication you demand for safe operation of your boilers.

There are no mechanically or electrically operated parts to wear, stick or get out of adjustment. Hydrostatic operation throughout means freedom from worry as to calibration or need for frequent maintenance. Accuracy is further enhanced by the Reliance patented Unitemp which compensates for temperature variation throughout the indication range.

The convenience of reading your water levels in the EYE-HYE works wonders in operating efficiency. The indicator is placed where operators are bound to see it frequently; the illuminated green indicating fluid provides a mistake-proof reading that duplicates the familiar boiler gage glass. Two flexible tubes form the easily installed connection between EYE-HYE, located on panel board or wall, and the boiler drum. Can be located below or above the boiler or other tank or vessel for which a dependable double check is desirable . . . Plan now for the efficiency of remote water level supervision guaranteed by positive hydrostatic action. Write for full information about Reliance EYE-HYE.

*About Vizzene Fluid

This is an exclusive bromine compound, insoluble in water, developed for use in EYE-HYE after long research—is not available for any other purpose. Vizzene is made in various specific gravities for selective use in best meeting the factors of calibration. It is non-inflammable, has a boiling point above and freezing point below water, is non-injurious in handling. Vizzene is obtainable only from Reliance or authorized sales representatives.

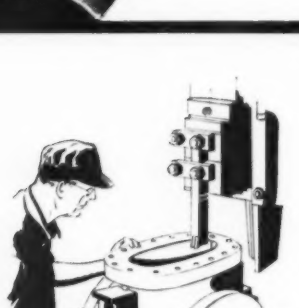

RELIANCE GAUGE COLUMN CO.
CLEVELAND, OHIO
EYE-HYE
PATENTED
MODEL NO. E-14 SERIAL NO. 5950
VERTICAL WATER LEVEL 12 INS. W. S. P. 725
USE ONLY VIZZENE D IN THIS GAGE
PATENTS NO. 1,665,667 - 2,068,135 OTHER PAT'S PENDING.

• *The more than 5000 in use prove the reliability of EYE-HYE's hydrostatic U-tube design. Their dependable performance is known on land and sea, on pressures as high as 2000 pounds, and even under vacuum. All leading power authorities have given EYE-HYE their approval.*

BOILER SAFETY DEVICES since 1884

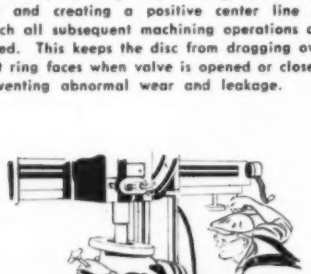
Reliance

THE RELIANCE GAUGE COLUMN CO. • 5902 CARNEGIE AVENUE • CLEVELAND 3, OHIO



HE GIVES LUNKENHEIMER VALVES SOMETHING OTHER VALVES HAVEN'T GOT

He machines body guides down to precision tolerances, assuring a perfect guide for the disc and creating a positive center line on which all subsequent machining operations are based. This keeps the disc from dragging over seat ring faces when valve is opened or closed, preventing abnormal wear and leakage.



PRECISION MACHINING THE BODY FOR SEAT RINGS

is precision work to the "nth" degree, for this operation makes inserting the seat rings in a Lunkenheimer gate valve simply a matter of screwing them into position. Parts can be replaced without any machine work or special fitting.

I. B. B. M. GATE VALVE
FIG. 1430

LUNKENHEIMER

LUNKENHEIMER PRECISION

ASSURES PERFECT-FITTING INTERCHANGEABLE PARTS... LONGER VALVE LIFE... EASIER, LOWER-COST MAINTENANCE

• The smooth-working efficiency and low maintenance cost of Lunkenheimer Valves were not "made in a day". Behind this superior performance and economy lies long experience, and an ideal of precision which guides every operation from design to final assembly.

Lunkenheimer Valves have a streamlined simplicity of design... a minimum of working parts, each part of extra strength, correctly proportioned and perfectly balanced. This assures longer life with the least trouble and maintenance expense.

A Lunkenheimer Distributor is located near you, equipped and ready at all times to help you solve problems of maintenance or operation.

BRONZE, IRON, STEEL AND CORROSION RESISTANT ALLOY VALVES, 125 TO 2500 LB. S.P.; BOILER MOUNTINGS, LUBRICATING DEVICES, AIRCRAFT FITTINGS

ESTABLISHED 1862

THE LUNKENHEIMER CO.

"QUALITY"

CINCINNATI 14, OHIO. U. S. A.

NEW YORK 13 CHICAGO 6

BOSTON 10 PHILADELPHIA 7

EXPORT DEPT. 318-322 HUDSON ST., NEW YORK 13, N. Y.

VALVES

[PUMP TIPS FROM ALLIS-CHALMERS—ONE IN A SERIES]

How to make WEARING RINGS Last Longer . . .

ANY NEW PUMP you buy is guaranteed to deliver its rating in capacity and head. But whether it *retains* its actual capacity depends to a great extent on the condition of its wearing rings. For when rings are worn thin, liquid leaks through the enlarged clearance between impeller and casing — seriously reducing capacity.

One of the major causes of excessive ring wear is misalignment. So serious can it be, that Allis-Chalmers engineers were led to develop, for many applications, the "Electrifugal" pump — in which *both* impeller and motor are mounted on *one* shaft and in *one* frame. This *unit-design* prevents parts in the pump's closely fitted body from getting out of "kilter" . . . helps you get longer life out of wearing rings.

However, regardless of whether you have a unit-design or separately coupled pump and motor, here are a few tips which will help you get longer wear from rings in your pumps . . .

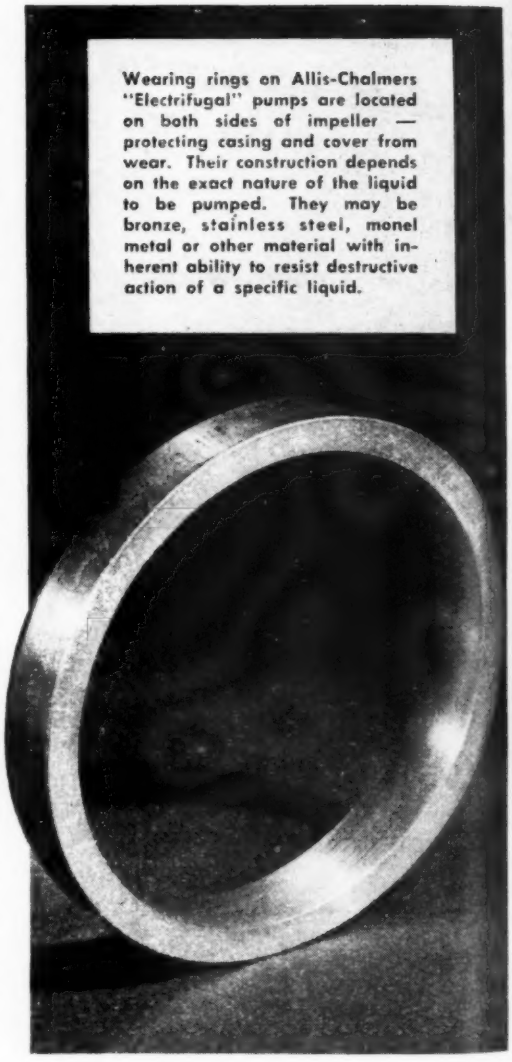
▸Never allow a pump to run dry — either through lack of proper priming when starting, or through loss of suction when operating. Remember . . . water is a *lubricant* between rings and casing.

▸Examine wearing rings at regular intervals. When new, rings in the smaller size, more commonly used pumps should have a diametrical clearance of about 0.006 to 0.008 inch on cold liquid service, and about 0.010 to 0.012 on hot liquid service. When ring clearance becomes 0.020 to 0.030 inch on the diameter it is more economical to replace rings than to pay for power lost in leakage through them.

▸Gritty liquid or foreign matter in liquid accelerates ring wear. If condition exists, provide intake end of suction piping with a suitable screen to filter out abrasive materials.

▸Watch pump alignment. Excessive strains from suction or discharge piping can and do distort casing. Wearing rings protect pump from serious damage in this event by themselves taking the wear. However, *before* installing new rings, be sure to check into the *source* of distortion.

▸Send for your *free* copy of "Handbook for Wartime Care of Centrifugal Pumps". This valuable booklet applies to *all* makes of pumps; contains *no* advertising. Contents include: tables of friction losses; guide to locating trouble; wartime maintenance schedule. ALLIS-CHALMERS MFG. CO., MILWAUKEE 1, WISCONSIN. A 1756

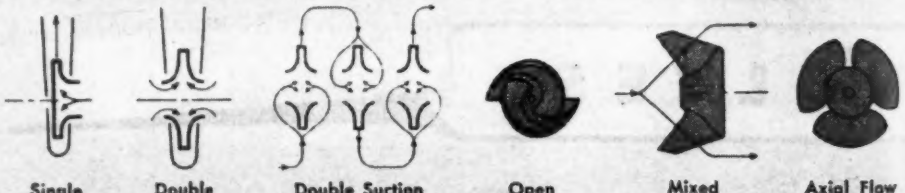


Wearing rings on Allis-Chalmers "Electrifugal" pumps are located on both sides of impeller — protecting casing and cover from wear. Their construction depends on the exact nature of the liquid to be pumped. They may be bronze, stainless steel, monel metal or other material with inherent ability to resist destructive action of a specific liquid.

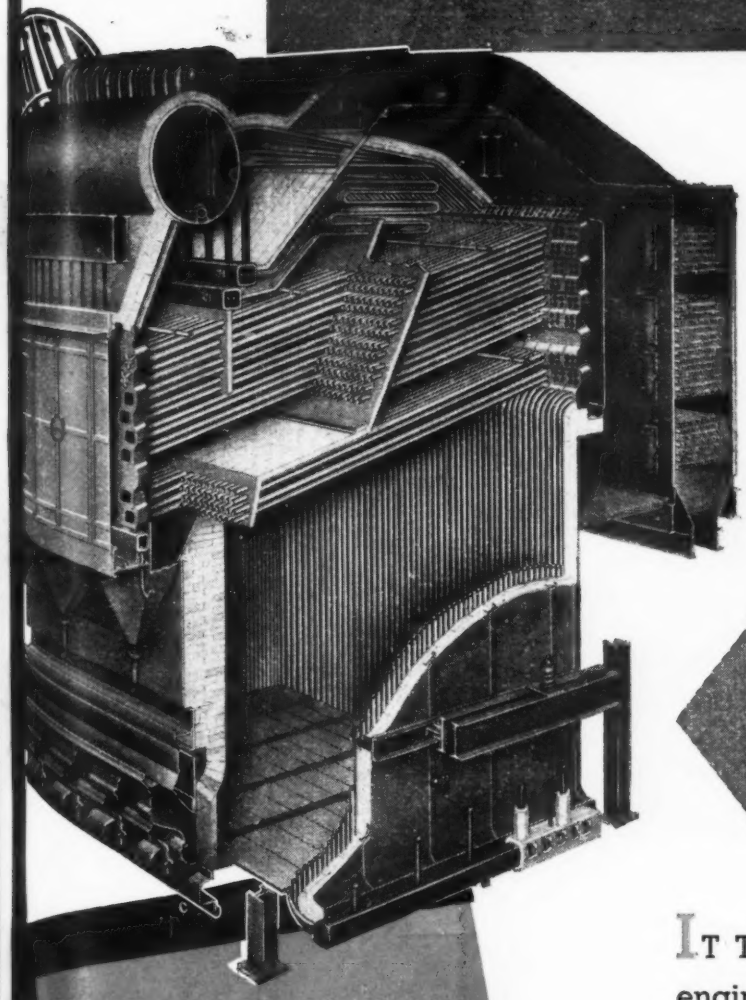
♪ *Tune in the Boston Symphony, Blue Network, every Saturday at 8:30 pm, EWT.*

ALLIS-CHALMERS PUMPS

Allis-Chalmers builds all types and variations of pumps shown at right. Capacities from 10 to 150,000 gpm—heads to 2500 lbs.



Single Suction | Double Suction | Double Suction Multi-Stage | Open Impeller | Mixed Flow | Axial Flow (Propeller)



CAST STEEL HEADERS — permit tighter rolled tube joints.

SECTIONAL ONE PIECE BAFFLES —make a rugged, permanently tight baffle wall.

STAGGERED GROUP TUBE ARRANGEMENT — gives maximum heat absorption, producing higher efficiency.

SECTIONAL HEADER DESIGN — saves 30 to 60 days erection. Tubes rolled in headers at factory.

PERMANENTLY TIGHT BAFFLES —records show as much as 20 years without maintenance.

SINGLE CROSS DRUM—designed for fast, dry steaming.

It took thirty years...

...to design this boiler!

IT TOOK OVER 30 YEARS and plenty of engineering courage to develop the modern Springfield boiler. In order to bring about higher efficiencies, faster steaming, greater responsiveness to load change, longer life of parts with less frequent and easier maintenance, Springfield engineers had to depart from previous concepts of design.

The fact that the first modern high ratings were accomplished with Springfield boilers is evidence of the success of this course.

For information on units to meet your requirements, write: SPRINGFIELD BOILER CO., 1953 E. Capitol Ave., Springfield, Ill.

SPRINGFIELD

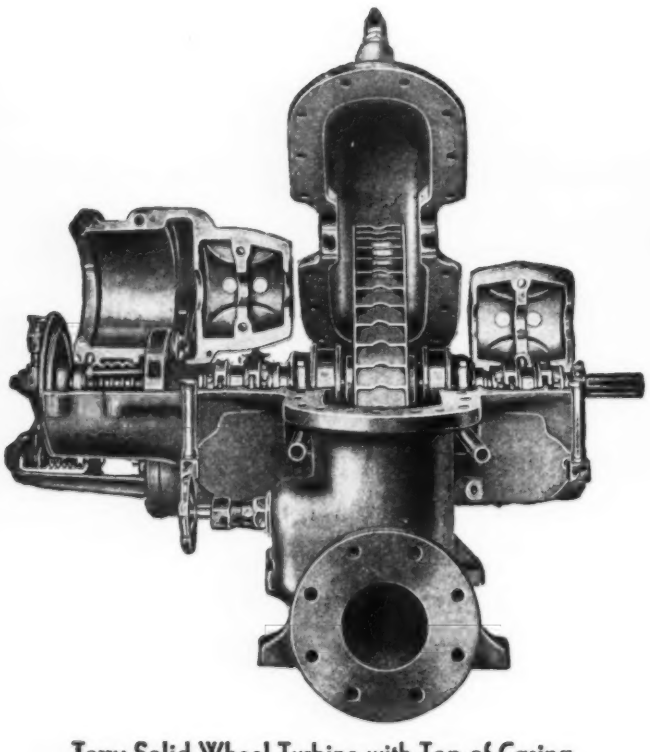
STEAM GENERATING UNITS

SPRINGFIELD BOILERS

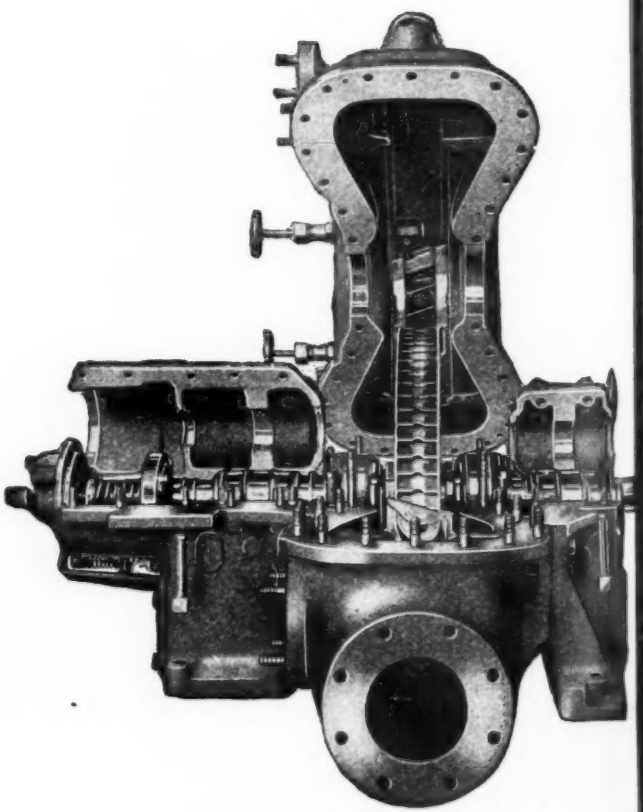
ANY SIZE ANY FUEL ANY PRESSURE

The TERRY

OFFERS COMPLETE COVERAGE OF MECHANICAL DRIVE TURBINES



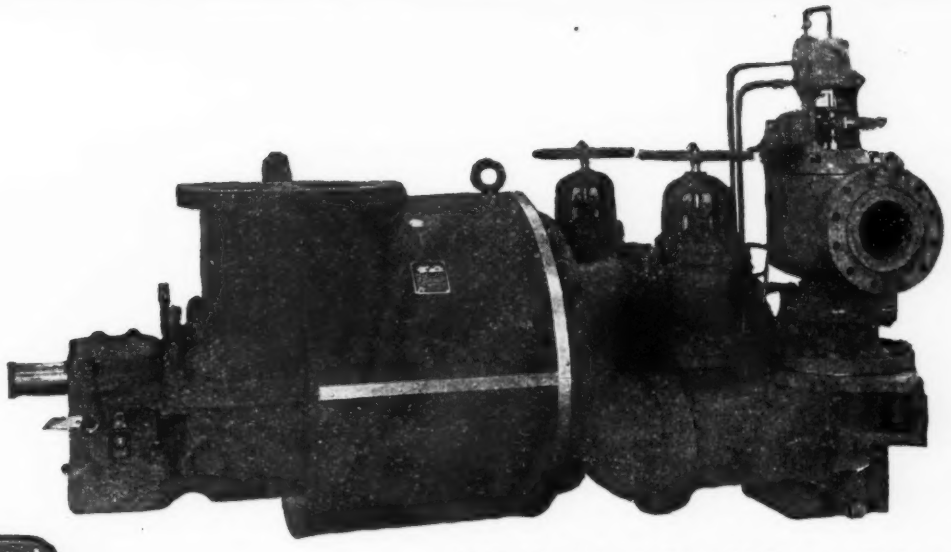
Terry Solid Wheel Turbine with Top of Casing Raised. Note the ruggedness and the ease with which the interior parts can be inspected — one of the country's leading oil companies employs 308 of these units for driving various types of refinery pumps. Full details are available in Bulletin S-116.



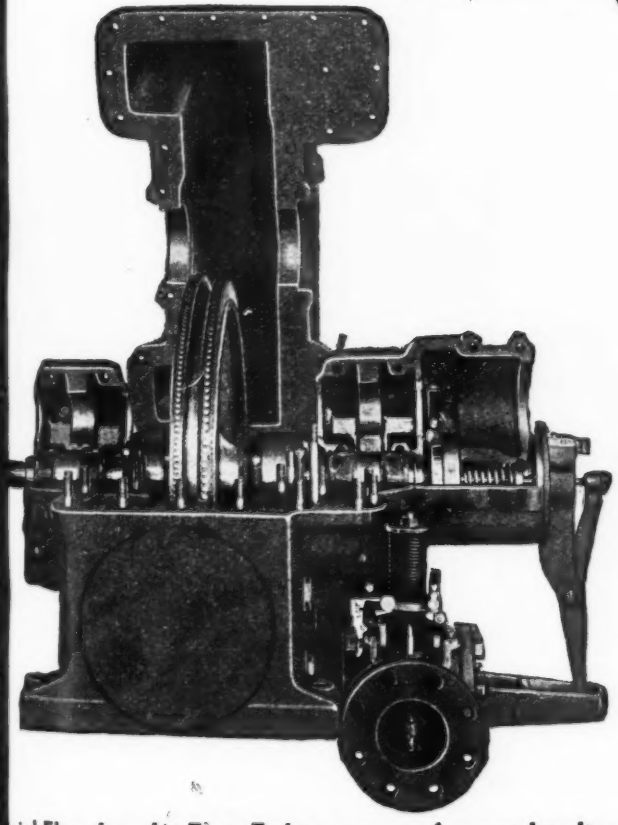
Twelve Terry Solid Wheel Turbines, simila to the above unit, drive auxiliaries in th power house of an east coast refiner. The operate with steam at 625 lbs. pressure — 700° Total Temperature. Eight of the ma chines exhaust against 125 lb. back pressure The first of these units was purchased in 1931 It proved entirely satisfactory so that as th plant was enlarged, duplicate Terry's were added. Bulletin S-99.

THE TERRY STEAM TURBINE CO.

TURBINE



1200 Horsepower Terry Multi-stage Turbine. Units of this type are employed extensively for driving large refinery pumps. The units may be designed for non-condensing, condensing, mixed pressure, or bleeder operation. They may be equipped with constant speed or variable speed governors, remote speed controls or with special governors to meet unusual requirements. Ask for Bulletin SR-114.



xial Flow Impulse Terry Turbine — one of a complete line built with either two or three rows of blading. These its, like all Terry turbines, are the result of over 45 years successful experience in the manufacture of turbine ives exclusively. Completely described in Bulletin S-107.

T-1151

TERRY SQUARE - HARTFORD, CONN.

FLAMENOL Showed No Aging

THIS FLAMENOL CABLE, after six years' exposure to weather, without covering, is as good as new. Note the glossy, uncracked surface.
THIS OIL-BASE, RUBBER-INSULATED cable, exposed to identical conditions over the same period, is dull and badly cracked.
THIS MINERAL-BASE, RUBBER-INSULATED cable, after the same exposure, shows the same dullness and cracking as the oil-base rubber insulation.

IN THIS SIX-YEAR TEST UNDER FLORIDA'S SUN

Back in 1937, a large railroad company operating in the South, where climate is particularly unkind to cable insulations, decided to test the stamina of various types of insulation. Two of the samples tested were the usual rubber-insulated types; the third was Flamenol. None was protected by braid or other covering, so that insulation was exposed directly to sun and weather.

In 1943, after six years of continuous exposure, the three samples were taken down, and examined. The dramatically conclusive results are shown in the photographs above. Only Flamenol had stayed young!

FLAMENOL RESISTS ACID, ALKALI, OIL, AND WATER

Before the war, millions of feet of Flamenol cable had already been installed in factories, oil refineries, mines and railroads; places where its ability to resist most solvents and heat made it a "must." In the future, this proved-performance cable will find even wider fields of application in reducing maintenance costs and minimizing shut-downs due to insulation failure.

Note, at the right, Flamenol's operating, installation, and maintenance advantages. For complete information, ask our local office, or write to *General Electric Company, Schenectady 5, N. Y.*

11 OUTSTANDING ADVANTAGES OF FLAMENOL

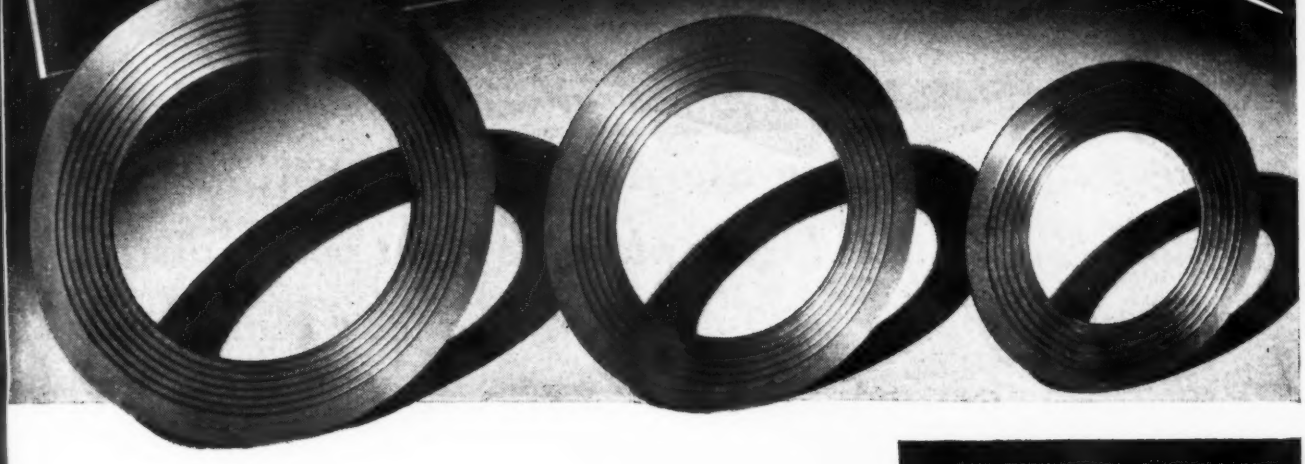
1. **FLAME RESISTANCE**—*will not support combustion.*
2. **CORROSION RESISTANCE**—*immune to action of oils, acids and alkalis.*
3. **SUPER-AGING**—*will not oxidize, therefore highly resistant to sunlight and weathering.*
4. **EXCELLENT PHYSICAL PROPERTIES**—*minimum tensile strength, 1,500 lb per sq in.; minimum elongation, 100 per cent.*
5. **CONSTANT DIELECTRIC STRENGTH**—*retained at about 720 volts per mil under severe operating conditions.*
6. **SMALL DIAMETER**—*saves space, and speeds wiring.*
7. **SMOOTH SURFACE**—*facilitates pulling through conduit.*
8. **VARIETY OF COLORS**—*simplifies circuit tracing.*
9. **FREE STRIPPING**—*steps up installation, avoids weakening nicks on conductors.*
10. **WIDE RANGE OF CONSTRUCTIONS**—*aids selection for special applications.*
11. **SELF-PROTECTING FINISH**—*eliminates need for braid covering, saves space and weight.*

Buy all the BONDS you can—and keep all you buy

GENERAL ELECTRIC

502-47-1209

Higher steam pressure MAKES TIGHTER JOINTS with these new self-sealing gaskets*



Here's a new way to lick leaking joints in high-pressure and high-temperature steam lines.

With Goetze Bellowseal Gaskets, line pressure itself maintains the tightness of the closure—*the higher the pressure, the tighter the joint.* For, as pressure rises, the two plates of the Bellowseal are forced apart into the packing to form perfectly leak proof joints.

You can get Bellowseals made in MONEL to meet all operating ranges and conditions. For high-temperature or corrosive service, MONEL is particularly suitable.

Use of MONEL cancels the threat of corrosion or oxidation which could make the seal inoperative through puncture or "freezing" of inside faces.

MONEL also supplies the full measure of high-temperature strength and resilience needed to withstand constant expansion and contraction. Moreover, its good welding qualities mean perfectly sound welded joints—thoroughly free from porosity—strong enough to take repeated flexing.

And from the viewpoint of the manufacturer (who has to groove the outer faces) the good machinability of MONEL is important, too.

Thus, in still *another* power plant application, MONEL is used as insurance for long life and trouble-free operation. Investigate MONEL and all the INCO Nickel Alloys whenever you need strong metals that fight heat, corrosion, wear and fatigue.

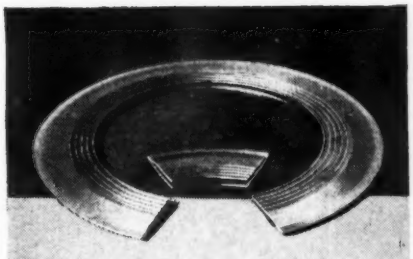
**As proved in tests using a 6" —400# A.S.A. Van Stone flange assembly with flange bolts only finger-tight. Gasket showed no leakage during cycle changes from 0 to 600 psi steam at temperatures from saturated to 850° F.*

THE INTERNATIONAL NICKEL COMPANY, INC., 67 Wall St., New York 5, N.Y.

NICKEL (INCO) ALLOYS

MONEL • "K" MONEL • "S" MONEL • "R" MONEL • "KR" MONEL • INCONEL • NICKEL • "Z" NICKEL

Sheet... Strip... Rod... Tubing... Wire... Castings... Welding Rods (Gas & Electric)



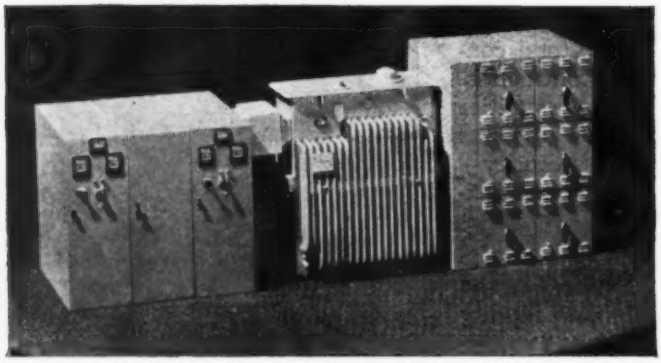
The new GOETZE BELLOWSEAL GASKET

consists of 2 discs of 1/16" metal, serrated on one face and welded together around their outer periphery. When installing the Bellowseal, a ring of thin, compressed asbestos sheet packing is placed over the serrations. Then, the joint is tightened up with sufficient bolt force to cause the latter to penetrate the packing. After penetration, bolt stress can be reduced to an operating value considerably lower than that usually necessary for all-metal gaskets. The slight bevel of the inner edges of facing discs ensures penetration of the pressure *between* the discs and expansion of the gasket. Bellowseals are made by the Goetze Gasket and Packing Co., Inc., New Brunswick, N. J.

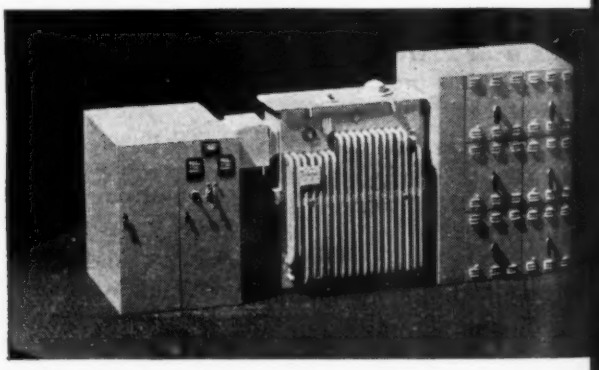
(The gasket above was tested beyond normal operating deflection to show the working principle of the new Bellowseal gasket.)

See how Flexible Unit Subs can be!

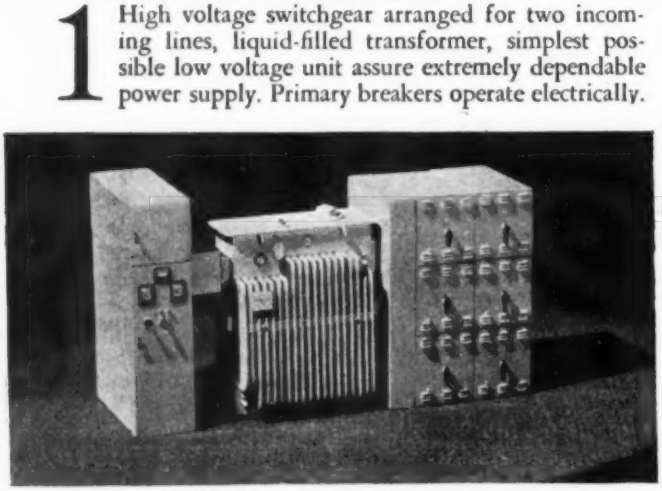
All possible substation arrangements are at your finger tips when you use Allis-Chalmers "Unit Sub Builder" Set to help you plan the right power distribution system for your plant. What load center unit substation arrangement is best for you?



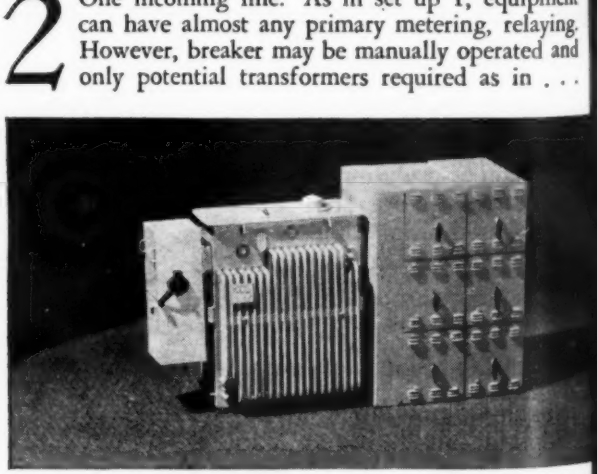
1 High voltage switchgear arranged for two incoming lines, liquid-filled transformer, simplest possible low voltage unit assure extremely dependable power supply. Primary breakers operate electrically.



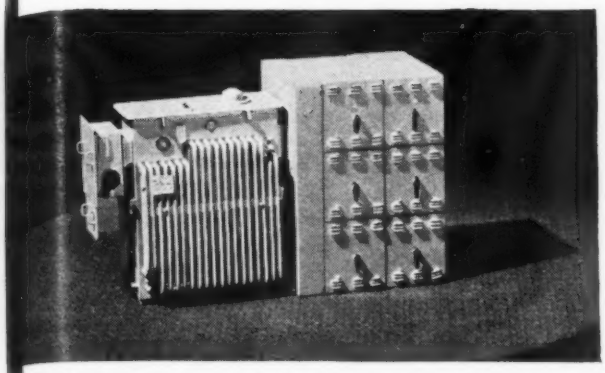
2 One incoming line. As in set up 1, equipment can have almost any primary metering, relaying. However, breaker may be manually operated and only potential transformers required as in . . .



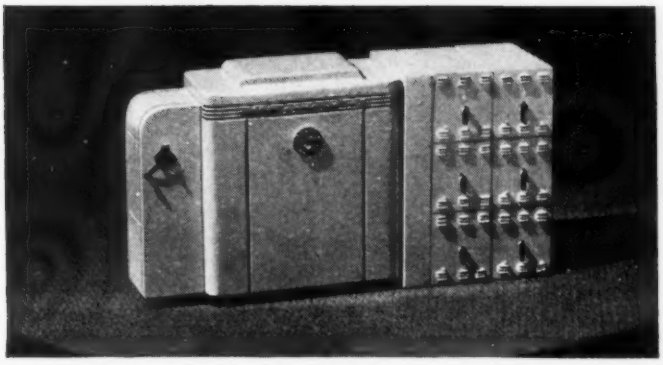
3 Common HV arrangement. Auxiliary compartment is not required. A set of potential transformers is mounted in a superstructure which can be removed if transformers are not needed.



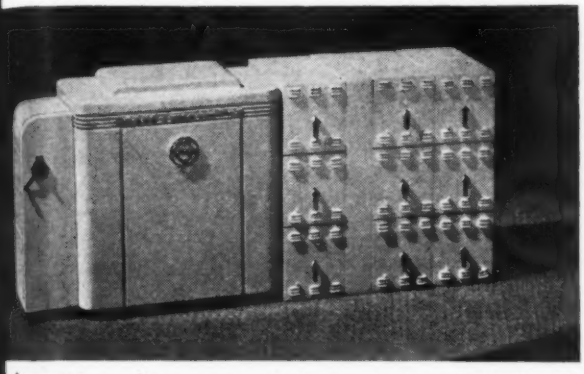
4 Load break switch-fuse — throat-connected (as here) or mounted directly on the transformer — replaces breaker. Where only disconnect switch is used, the substation would appear as set up 5.



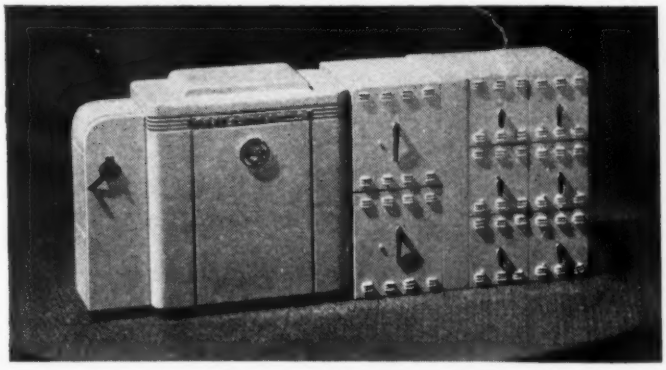
5 Disconnect switch is most common HV arrangement. Requiring back-up protection of a circuit breaker, it is used with liquid-filled transformer (above) . . . or dry-type (next illustration).



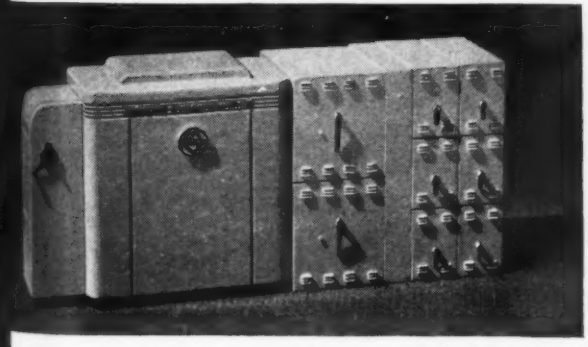
6 If disconnect switch will break magnetizing current only, it requires an interlock. Simplest and most positive is a key interlock to the transformer secondary breaker, as in photo 7.



7 Here, disconnect switch may be interlocked with main secondary breaker. However, all current from the transformer must flow through this breaker — requiring a larger breaker as in . . .



8 A 750 kva, 240 v transformer needs 50,000 amp breakers if direct-connected to transformer. Main breaker, when used (photos 8, 9) must carry 1800 amps, be rated 75,000 amps.



9 Same transformer . . . using cascaded 75,000 amp main breaker, 25,000 amp feeder breakers. Main breaker can handle maximum short circuit of 48,000 amps. All feeders lose load when one faults.

10 To see how Allis-Chalmers "Unit Sub Builder" Set can help you, call your nearby A-C district office for a showing. No obligation, of course. ALLIS-CHALMERS, MILWAUKEE 1, WIS.

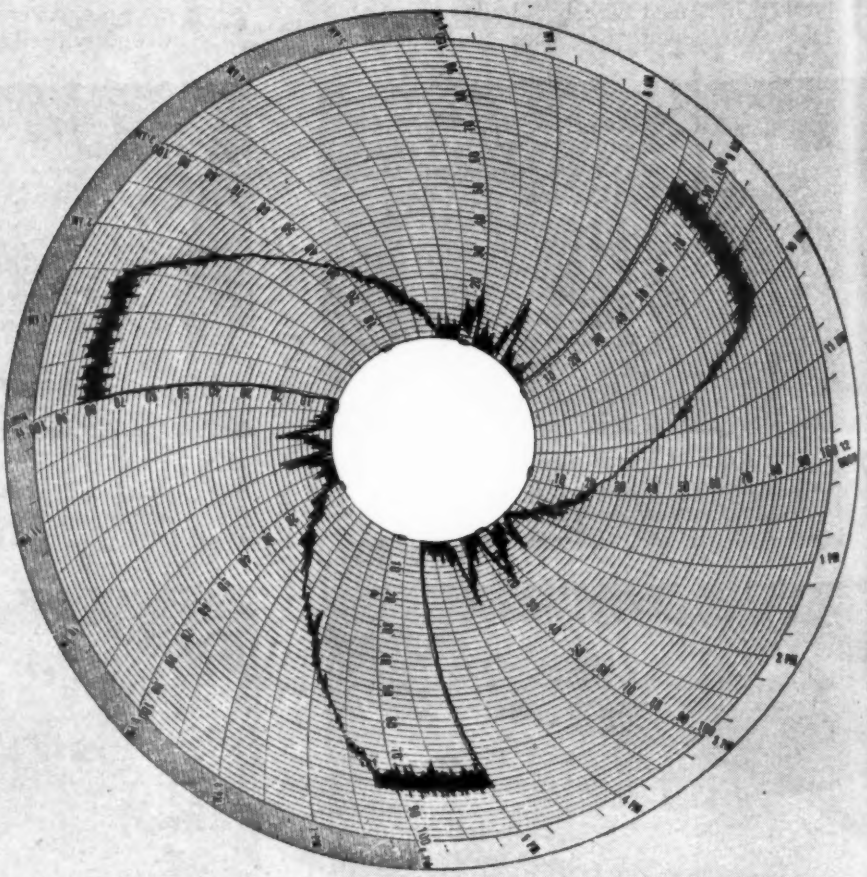
A 1830

See your Unit Sub ideas worked out with ALLIS-CHALMERS "Unit Sub Builder" Set

A-C

Tune in the Boston Symphony, Blue Network, every Saturday at 8:30 pm, EWT.

The flow-meter "No fuel"



HAGAN CORPORATION, HAGAN BUILDING, PITTSBURGH 30, PA.

said

but the Hagan Control knew better

IT HAPPENS RIGHT ALONG in a Pennsylvania steel plant, where Hagan Automatic Combustion Control is used on soaking pits.

Large amounts of fuel are needed to bring the cold ingots up to temperature. After they have been heated, a very small percentage of the maximum amount holds the pit temperature at the correct level. When fuel demand drops down around 8%, the flow meter registers zero—but hour in and hour out Hagan Control continues to supply the right amount of fuel to maintain the right temperature.

Only one thing makes this possible—the Hagan principle that *controlling and recording are separate functions.*

The operation of the Hagan Automatic Combustion Control System is dependent on the functioning of a number of coordinated regulating machines, each designed for its specific job as a *regulator*. Its efficiency has not been impaired by attempting to make it serve the dual purpose of controlling and recording.

Every secondary recording instrument on the panel can be inaccurate or out of service without the slightest effect on the functioning of Hagan Control.

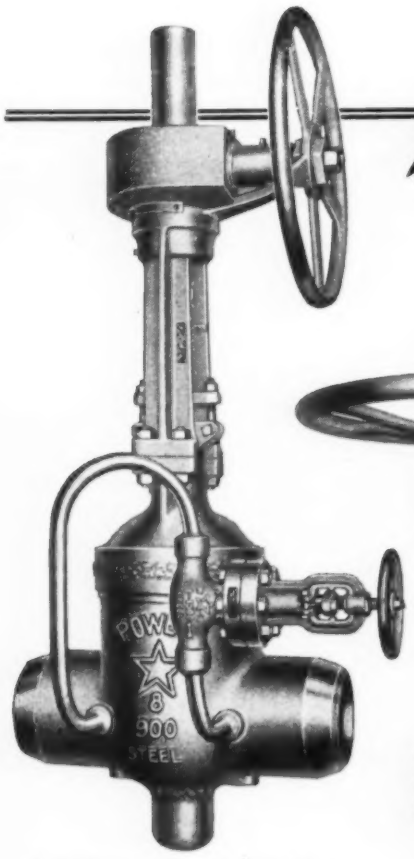
Write for full information.

HAGAN
HALL
BUROMIN
CALGON

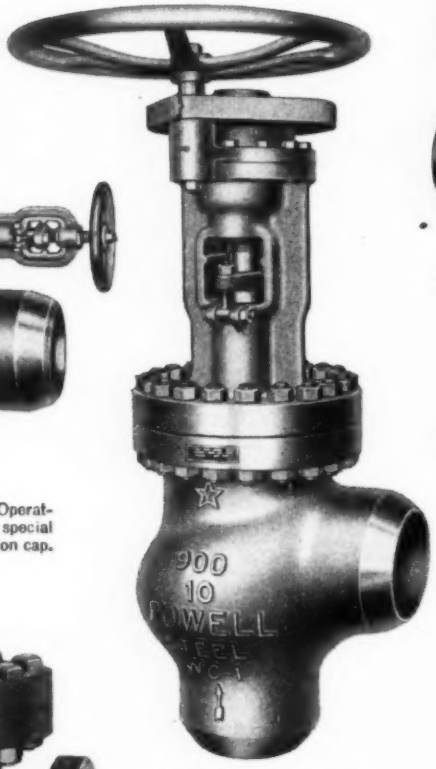
HAGAN *Automatic* COMBUSTION CONTROL

The pioneer . . . and still the leader

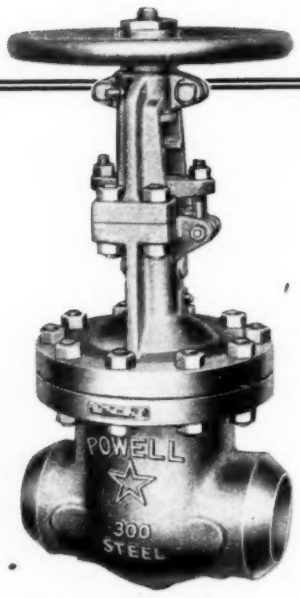
There'll always be



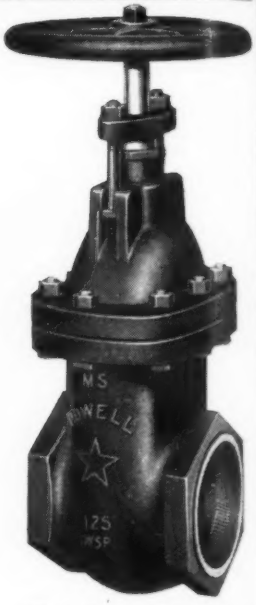
Class 900-pound Cast Steel, Gear Operated Gate Valve with welded Bonnet, special by-pass and sediment and inspection cap.



Class 900-pound Cast Steel Non-return Angle Valve, spur gear operated.



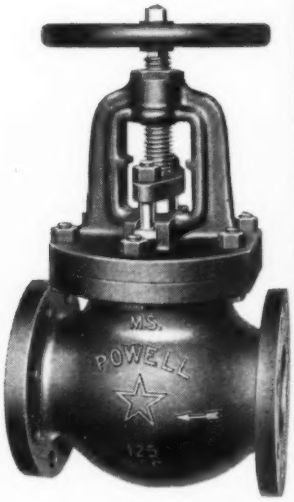
Class 300-pound Cast Steel Welding End O. S. & Y. Gate Valve.



125-pound Iron Body Bronze Mounted Non-rising Stem Gate Valve.

200-pound Bronze Gate Valve with renewable disc.

250-pound Iron Body Bronze Mounted Regrinding Swing Check Valve.



125-pound Iron Body Bronze Mounted or All Iron O. S. & Y. Globe Valve.

POWELL

POWELL VALVES

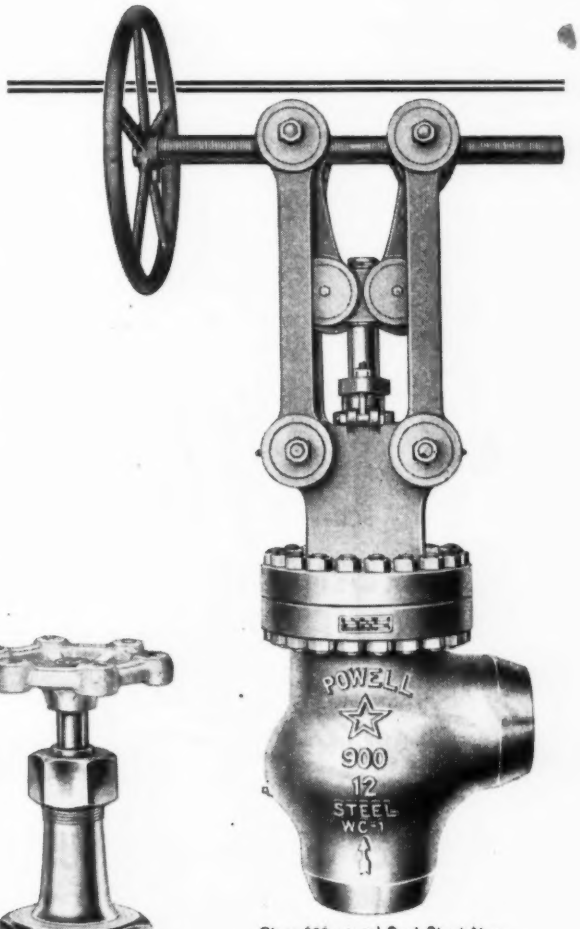
for the Power Plants of *Tomorrow.*

The "KNOW-HOW" acquired through 98 years of making valves—and valves only—has enabled POWELL Engineering to design valves to meet every problem of wartime flow control. This same "KNOW-HOW" is your assurance for the *post-war* future. Shown here are a few examples of a complete POWELL Line especially adapted to your industry. As new requirements arise, there'll be POWELL Valves to meet them.

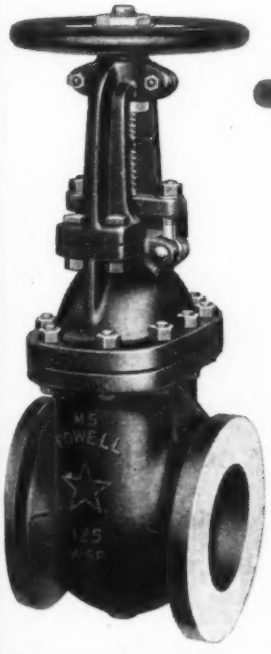
The Wm. Powell Company

Dependable Valves Since 1846

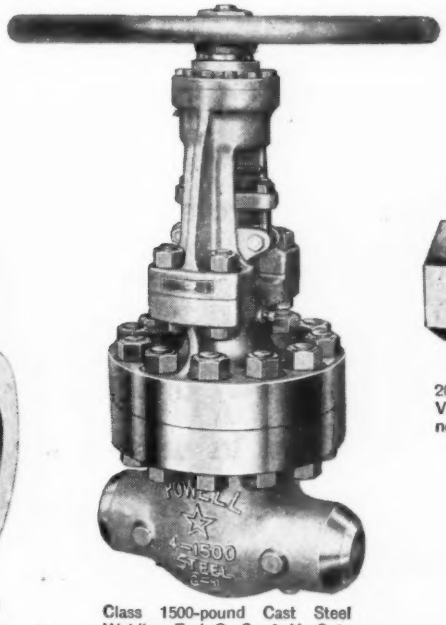
Cincinnati 22, Ohio



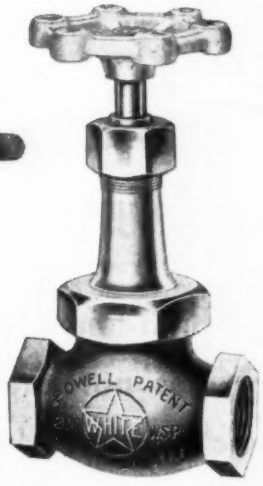
Class 900-pound Cast Steel Non-return Angle Valve, toggle operated.



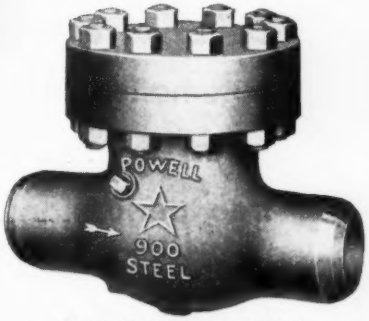
125-pound Iron Body Bronze Mounted or All Iron O. S. & Y. Gate Valve.



Class 1500-pound Cast Steel Welding End O. S. & Y. Gate Valve.

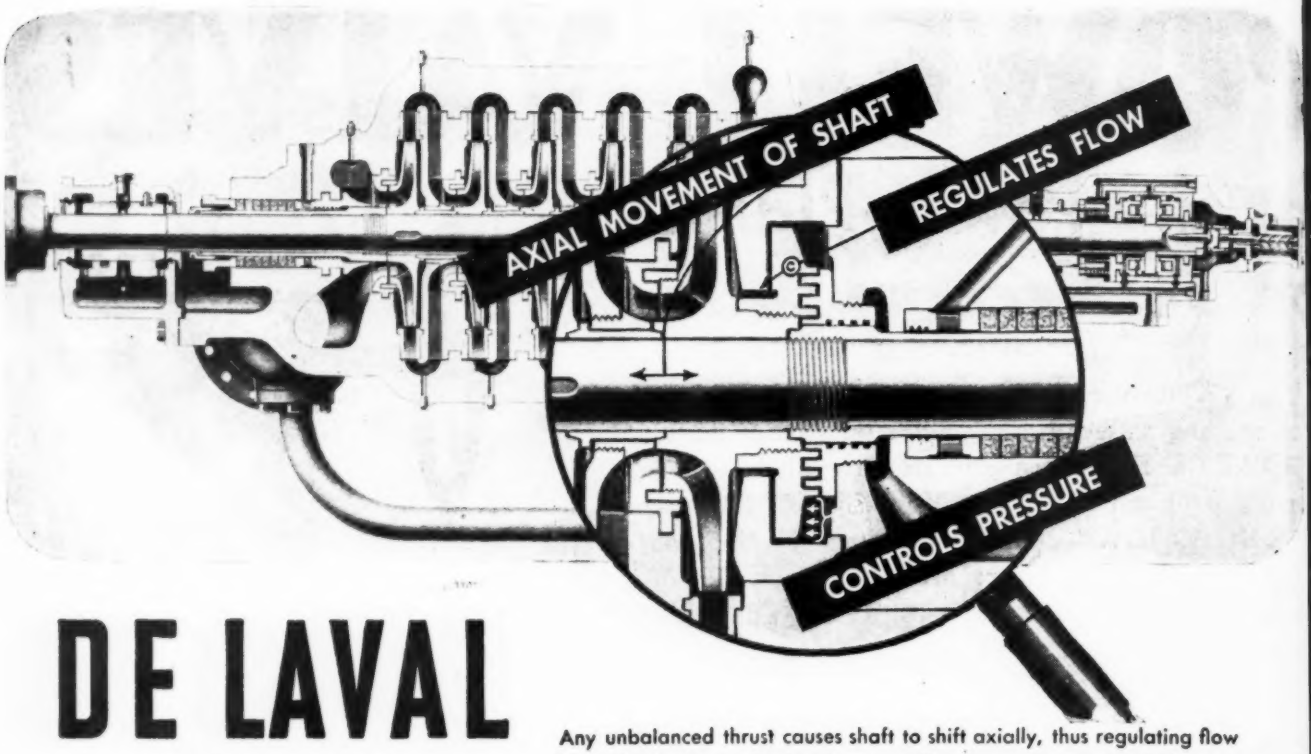


200-pound Bronze Globe Valve with regrindable, renewable seat and disc.



Class 900-pound Cast Steel Welding End Swing Check Valve.

VALVES



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Any unbalanced thrust causes shaft to shift axially, thus regulating flow through clearance C, thereby controlling pressure against balancing disc A and thus automatically returning the pump to a state of perfect balance. Note that this hydraulic device leaves no unbalanced thrust to be taken up by bearings or other metallic contacts subject to wear.

ELIMINATES SOURCE OF TROUBLE IN HIGH-PRESSURE BOILER FEED PUMPS

The erosive action of high-temperature feed water in a high-pressure boiler-feed pump does not interfere with the operation of the De Laval automatic hydraulic balancing arrangement, since the automatic action of this device is in no way affected by normal wear, as can be seen from the illustration. Its universally trouble-free performance has been demonstrated over a period of 30 years in hundreds of installations, handling feed water up to 350° F. and discharging against pressures up to 1600 psi.

3630

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A CROSS-INDEX OF SUBJECTS FOR THE MONTH

PLANT OPERATING METHODS, MAINTENANCE AND SAFETY

STEAM GENERATION, FUELS, FIRING AND COMBUSTION

TURBINES, ENGINES, AUXILIARIES; HYDRO POWER

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INSTRUMENTS, CONTROLS

PUMPS, COMPRESSORS

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PLANNING POSTWAR POWER?

Two steam power plants are seldom the same. Usually, each has its special set of requirements and operating conditions. These will govern the equipment selected. But there *are* certain *basic* principles, common to all, governing the *type* of equipment. They've been evolved through experience—and tested in use.

Whether you're building a new plant or expanding an old one, these principles will serve as a valuable guide for your functional planning. Westinghouse, builder of the majority of products in a modern power plant, is well qualified and ready to place this information at your disposal.

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GETTING STARTED

Types of Turbines
Sizes of Turbines
Turbine Speeds

PART TWO

PERFORMANCE DATA

Basic Operating Conditions
Deviations in Operating Conditions
Approximate Over-All Dimensions
Recommended Condenser Sizes
Choice of Condenser Size
Condenser Data Charts
Condenser Dimensions
Condenser Friction
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For a copy of this valuable new planning book, call your nearest Westinghouse Office. No obligation, of course. Westinghouse Electric & Manufacturing Company, Box 868, Pittsburgh 30, Penna.

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Steam Headquarters

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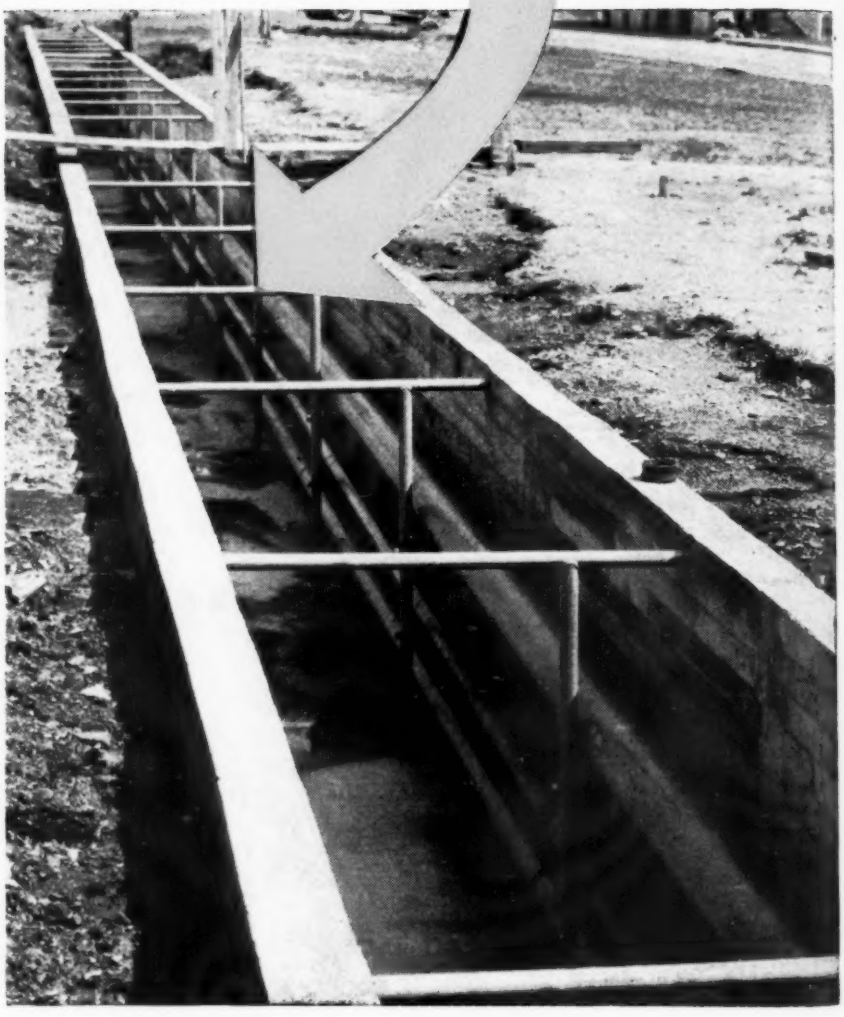
is a veteran in the "UNDERGROUND"



Every engineer who has to install or maintain underground steam lines will understand the problem confronting the Veteran's Hospital, Chillicothe, Ohio. A 4-inch vacuum return and a 3-inch medium pressure drip line had to be installed in an existing tunnel.

Such lines are cold during a major portion of the year, and it is practically impossible to keep moisture from accumulating in the duct. Once a film of water forms on the pipe, atmospheric gases are dissolved in it, and corrosive attack invariably follows.

Fortunately, the engineers had an excellent guide in material selection right before them: a 6-inch wrought iron steam supply line, installed in the tunnel in 1927. The new lines are Byers Wrought Iron.

If further evidence of wrought iron's durability had been required, our engineering files would provide plenty. One example is a wrought iron underground steam line installed in a New England college in 1897. Practically all of it is still in use.

Wrought iron's unusual resistance to corrosion is of course the result of its unusual structure. Tiny fibers of glass-like silicate slag are threaded through a high-purity iron base. The network of fibers helps halt and diffuse corrosive attack, and discourages pitting. Also, the fibers assist in anchoring any initial protective film, which shields the underlying metal.

Our bulletin, "Wrought Iron for Underground Services," is packed with interesting and helpful information, and well repays reading. We will be very glad to send you a complimentary copy.

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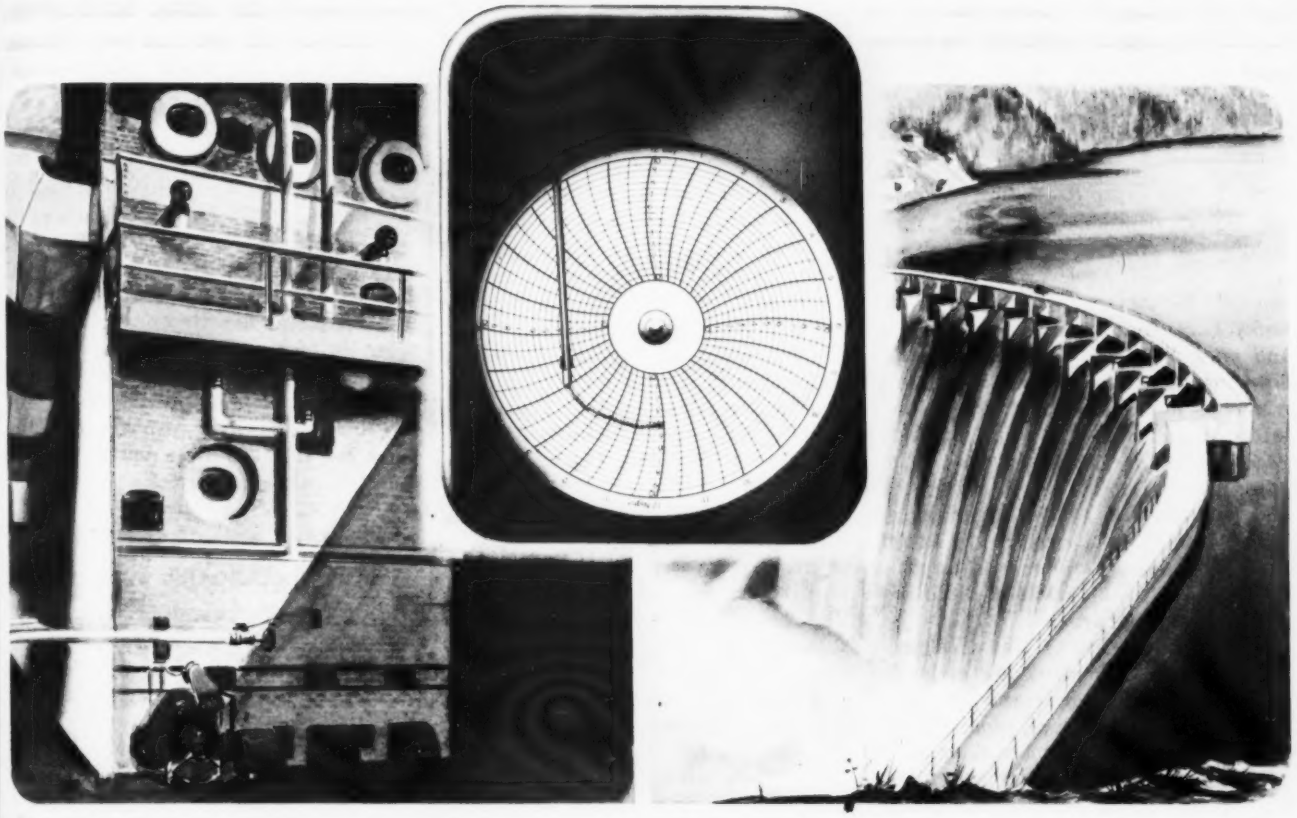
MEASURING AND CONTROLLING



LIQUID LEVEL

BY

E W FELLER

Associate Editor

Power and instrumentation go hand in hand. Industry spends untold millions for ingenious devices to measure and control the pressure, temperature and flow of steam, water, air and other power and process fluids. This investment pays handsome dividends in product improvement, reduced waste, lower cost and the release of human energies for creative work.

Now we see the beginnings of a new phase of instrumentation, in which measuring and control devices have become *necessities* of operation, not merely *improvements*. With advancing technology many power and process operations have grown so complex that human eyes and hands can no longer keep pace, even if waste and poor quality could be tolerated.

Thus instruments make three distinct contributions to American living standards; better-quality products, lower-cost products, and completely new products.

Each such forward step places new responsibilities on the power engineer, for he must master a constantly widening range of equipment and applications. Instrumentation must be his continuing study, with increasing emphasis on the indication and control of liquid level, a rapidly developing art in all phases of power and process operation.

From many scattered sources of information on liquid level, POWER brings together, in this its 53rd special section, a unified practical presentation of fundamentals with many examples of actual measuring and control devices. While "complete" coverage is impossible in 24 pages (or 100 pages, for that matter) the selected examples will give engineers a good general idea of the principal types of liquid-level indicators and controls. This should provide a foundation for selection, installation, operation and maintenance.

APRIL, 1945 **POWER** **P W SWAIN, EDITOR**

Simple Level Indicators

Most elementary device for measuring liquid depth is the chain that sailors use to take soundings. This simple method, however, is not convenient for factory or power-plant tanks because of their many shapes and sizes and their location at many different elevations. Among other means to indicate a true level of contained liquid are *staff gages, floats, gage cocks, gage glasses* and *pressure gages*. Liquid level is also indicated and regulated by *controlled air pressure* in a pipe submerged in the liquid and by *pressure-differential* instruments, both of which will be discussed in the following article.

A staff gage, Fig. 1, the least expensive and easiest device to make, is commonly used on reservoirs and open tanks. It is nothing more than a piece of channel iron or wood planking with divisions representing quantity or feet of elevation above reservoir bottom.

FLOAT CHARACTERISTICS

A float is made of buoyant material or metal, which rises and falls with the liquid and thus operates indicator or controller. An organic-material float soon loses buoyancy unless given a liquid-proof coating. Boiling in paraffin or beeswax protects against water; shellac prevents oil absorption. Periodic renewal of a coating extends service life considerably because once the surface becomes cracked and the float soaked, it cannot be dried satisfactorily unless the entire coating is removed. A metallic airtight float, Fig. 2, eliminates liquid absorption and, although slightly higher in first cost, replacement frequency and over-all cost are low. Operating shafts pass through packing glands or flexible diaphragms. Two solid metal weights balanced against each other in the same vessel, Fig. 3, also register level.

For active liquids, the float must have rigid guide rods or be restricted by still wells to prevent its floating around on the surface and giving a false reading. For tanks below floor level, the float is fastened to a rod and target that moves vertically along a staff gage; for overhead tanks a flexible cable moves the target up and down a staff gage mounted vertically on the outer tank wall.

With only a single pulley, float moves target toward staff-gage foot as tank fills. A triple pulley and counterweight arrangement reverses target movement so that its position corresponds to that of the liquid. Self-contained float chambers mounted on the side of tank or boiler at normal liquid level, Fig. 2 and 3, indicate within a narrow range when the supply exceeds or falls below a given amount.

A gage cock, although sometimes used alone, is more often installed as an emergency check against other level indicators, such as gage glasses. Upper one, Fig. 4, uses the threaded stem; lower is opened by a lever-operated pushbutton.

A gage glass constitutes one leg of a U-tube, the other leg being the tank or vessel itself. Liquid in the two sides of a U-tube assumes a common level as long as both ends are acted upon by the same temperature and pressure. Higher pressure on one leg forces the liquid down until the height in the opposite leg equals and balances this higher pressure. Temperature difference or a change in specific gravity (steam bubbles) of liquid in the two legs also unbalances the level. This accounts for a slightly higher water elevation in a boiler drum than that shown by the gage glass if it is some distance away.

Gage glasses are more commonly used for inside storage tanks and boilers if level indications need not be transmitted. They can have both ends connected, Fig. 3; or, as in the bearing-oil-level indicator, Fig. 5, only one end connected. When using the single connection on a vessel vented to atmosphere the free end of gage must also be vented, or a false reading results. A motor-bearing oil-level well having its upper end closed by a hinged metal flap depends on uneven contact of the metal cap for venting. If the cover is flapped closed continually it hammers the metal to an airtight seal against atmospheric pressure and the oil then rises and seeps out under the cover; correct this by drilling a vent hole in the cap or filing a notch in the well's top edge.

SUGGESTED MAXIMUM WORKING PRESSURES: TUBULAR GAGE GLASSES

Length, in.	*Corning Standard, psi*	*Pyrex: broad red line, red line and high pressure, psi*	*Pyrex heavy wall, psi*
Up to 10	200	500	600
11 to 20	200	420	600
21 to 30	200	340	600
31 to 40	180	290	.....
41 to 50	160	220	.....
51 to 60	130	180	.....
61 to 70	100	140	.....

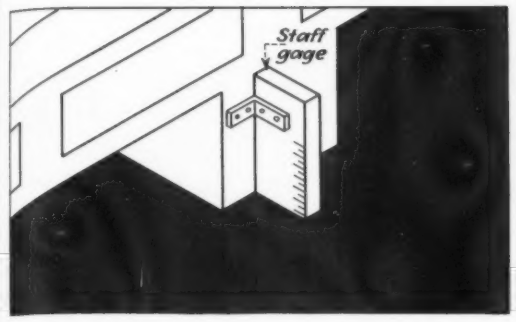
TUBULAR-GLASS STRESSES

Tubular glasses must withstand the pressure acting on the cross-sectional area of the tube end as well as internal surface pressure. A short glass is quite stiff and not appreciably bent by this loading and its resistance to internal pressure is practically unaffected. A long tube, however, tends to bend, stressing the tube wall and adding to stress already caused by internal pressure.

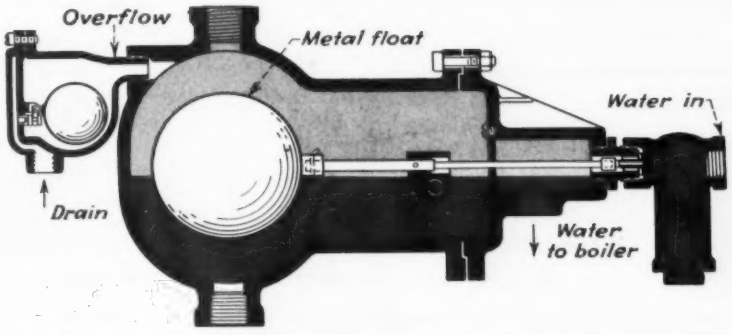
Although there are no hard and fast rules covering gage glasses for different pressures, recommended practice has placed certain limitations on the kind and length of glass (see table). This is supplemented by a recommendation that flat glass be used on power boilers for all pressures up to 350 psi, and flat glass with mica inserts or mica alone for higher pressures.

Buy circular glass of the best material available. It should preferably be already cut to correct length because the manufacturer is equipped to produce a good fused end. Most operators prefer the inside cutter for circular glass as it prevents flaking the inside edge. After cutting, fuse the ends to a smooth surface. Always allow sufficient length to reach past the upper packing recess when the glass rests on its seat in bottom gage fitting. Letting the glass extend too far into the upper fitting gives greater opportunity for etching to take place. Any extensive sign of etching is a warning to replace the glass. Metal objects nick it and should not be used in cleaning.

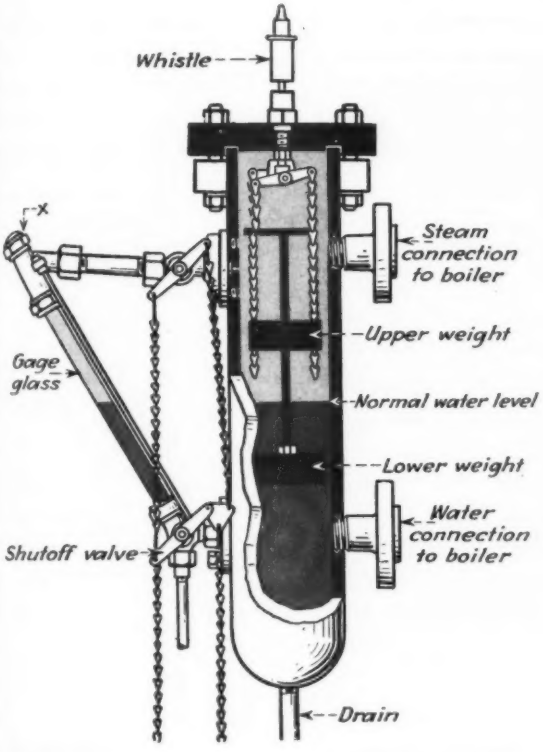
Rate of attack on glass by condensing steam varies with temperature and water pH. Every drop of condensate that trickles down a gage glass shortens its life. A windy or rel-



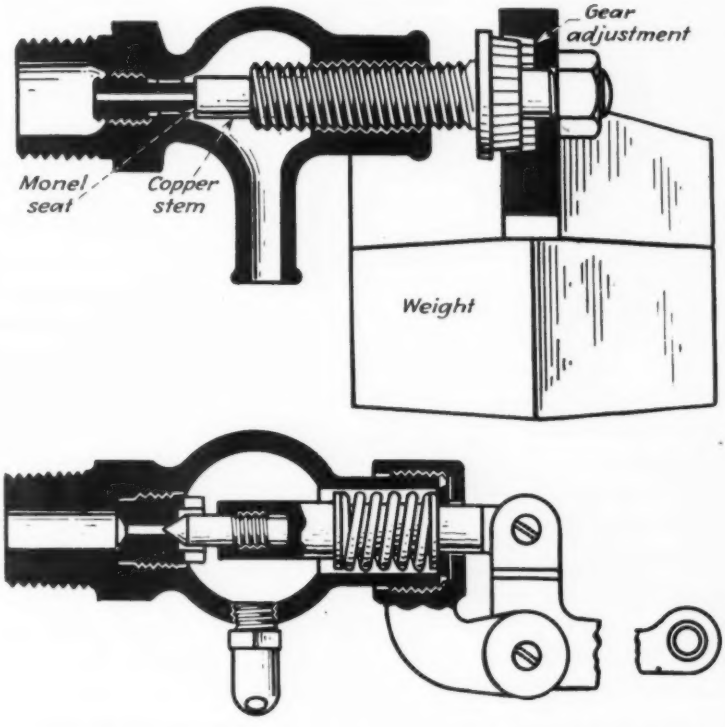
1—Wood or metal staff gage serves as an indicator in an easily accessible open tank or reservoir



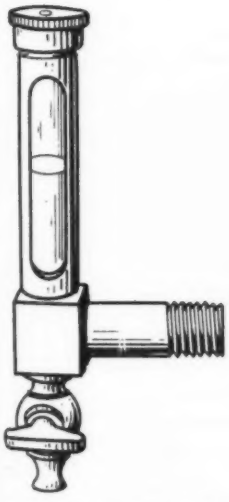
2—Metallic airtight floats eliminate trouble from liquid absorption. They cost more than organic floats but, in most cases, last longer



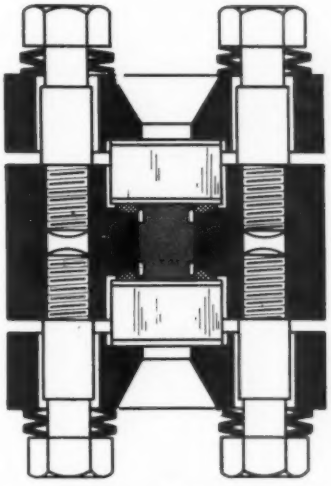
3—Balance of two opposed solid metal weights is upset if both hang free or both are submerged



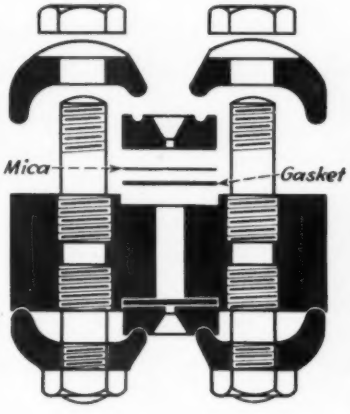
4—Gage cocks usually act as an emergency check against other indicating methods where the liquid can be discharged without harm



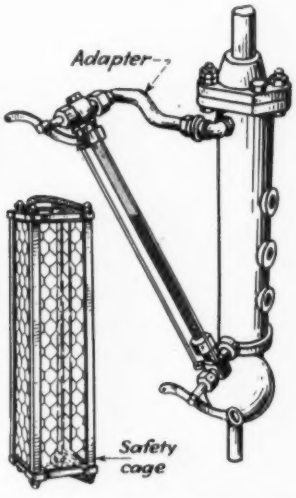
5—Single-connection gage serves bearings



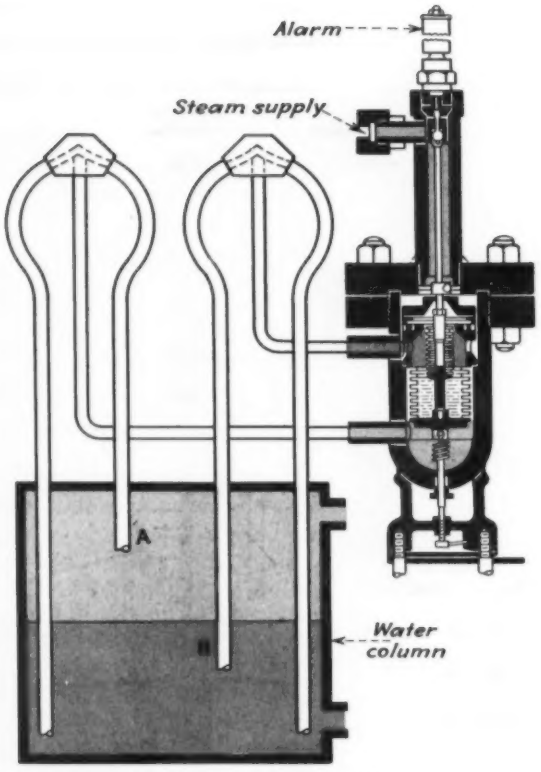
6—Clear flat glass forms the sides of this boiler gage glass



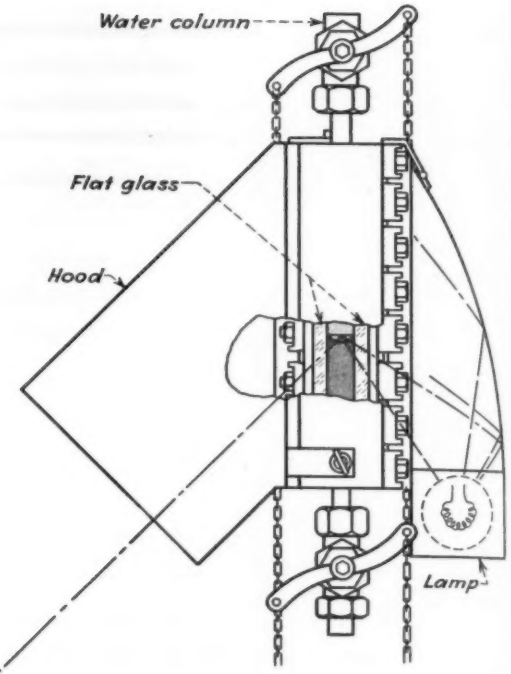
7—Mica proves more resistant to etching attack than does glass



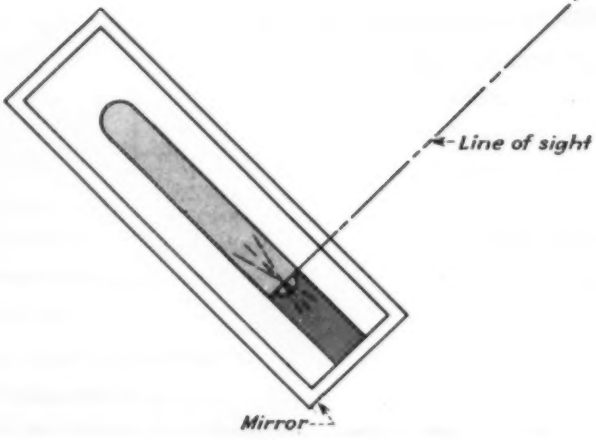
8—Adapter inclines the gage; cage prevents injury

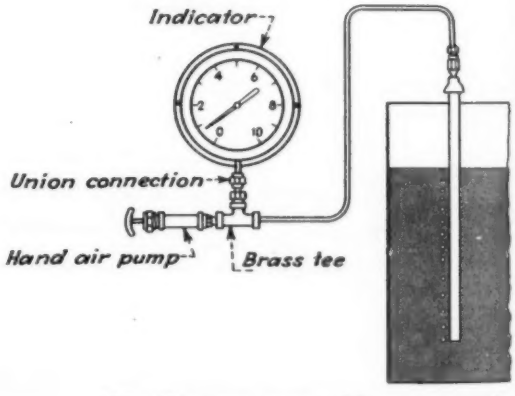


9—Two pipe loops in water column apply differential pressure to alarm

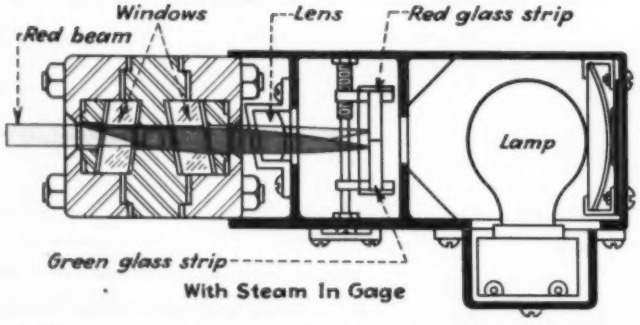


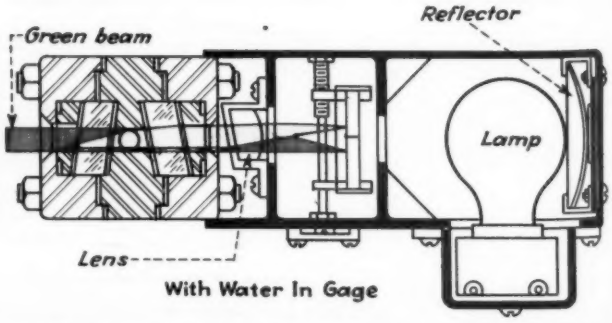
10—Light and reflector behind a flat gage glass project the image to a distant mirror at the operating-floor level





11—Pressure gage with proper scale and air-filled pipe indicates liquid level





12—Beams of red and green light project through lens to strike gage window at different angles. In the steam area, green bends out of vision but red remains visible; in the water area, green remains visible but red bends out of view

atively cool location hastens condensation. Condensate from inlet steam piping should drain back to the water column instead of down through the glass. If this cannot be avoided a tapered nipple inserted in upper end of a vertical glass causes droplets to fall free. Composition of water in the gage glass constantly changes because condensed water continually enters, but quiescent conditions prolong glass life.

To install a new glass, remove plug *X*, Fig. 3 on page 65, (when provided) from the upper fitting and insert the glass at this point. Turn plugless upper fittings slightly to one side, insert upper end of glass, and then turn fitting back so that lower end can slide into lower fitting. Glasses should be of the correct diameter to slip easily into the gland—if they are too tight expansion against the metal breaks the glass.

After the glass is in place, push packing and packing-follower washer into the glands. Packing should enter easily without being forced. Never use a wrench to turn down the gland nut; thumb-tight is sufficient and allows for normal expansion. Test by turning the glass by hand. If a wrench is needed to stop leakage, insert new packing instead of applying extra pressure to the old. Slight initial leaks cease when full operating temperature is reached.

PACKING WASHERS

Packing washers of poor quality lose their resiliency quickly and soon permit steam to escape; this rapidly increases until the entire washer blows out or sufficient steam escapes to set up violent vibration and unequal expansion. Gage-glass washers for low and medium pressures are made from a high-grade vulcanized composition; for higher temperature and pressure, asbestos or metallic packing is necessary. Asbestos is not recommended for circular glasses as it grips the glass too tightly and prevents longitudinal expansion.

The flat gage glass is available in two designs: one with clear and the other with reflex glass. The clear, or plain glass, Fig. 6 on page 65, forms two sides of a case containing the column of water. With proper illumination behind the glass, water level is plainly visible. Reflex glasses have longitudinal ridges on the back surfaces that act as prisms to reflect light above the water level, giving that portion of the glass a bright silvery appearance which contrasts sharply with the dark area below the water level.

Mica inserts are used with flat glass because they offer high resistance to etching and lengthen glass life considerably. When used alone, Fig. 7, a mica thickness of 0.025 in. is suitable for pressures up to 450 psi; for higher pressures mica should be at least 0.035 in. thick. Resplit discolored mica and save the good sheets for building up other inserts.

Flat glasses, which have a large area clamped by metal parts, need metal frames to support the glass uniformly around its rim. Uniform tension is assured by spring washers, Fig. 6. When installing a new glass draw clamping nuts up thumb-tight and then tighten in pairs to give uniform clamping sufficient to effect a positive seal.

Gage-glass protectors made of wire-embedded polished plate glass prevent injury from flying bits of broken glass, hot water and steam. Guard consists of a metal frame supporting the 4-sided glass inclosure, Fig. 8, suitable for mounting around the circular gage glass. The plates withstand the shock of a bursting glass and will not shatter or fly.

For high overhead gages an adapter, Fig. 8, transforms a vertical glass into an inclined one. This permits easy level reading from operating floor. Adequate lighting or a beam, directed from a spotlight mounted at an angle below the glass, also helps visibility. A painted plate with barber-pole stripes placed behind the gage glass makes the water level stand out with greater clearness. Another method places a vertical stripe on the back of the round glass. A reflected light and mirror, Fig. 10, brings gage image to operating floor.

A 2-color reflecting mirror device operates on the principle that refraction of a light beam differs as it passes obliquely through different substances. When the beam passes through air or steam the amount it bends is not the same as when it passes through a column of water.

Parallel panes of red and green glass stand between the light source and a lens adjacent to the gage glass, Fig. 12. The gage glasses set at an angle with each other utilize the difference in refraction between water and steam to best advantage. Beams of red and green light project through the lens and strike the gage window at different angles. In the steam area, the green beam bends out of vision but in the water area it remains in view. On the other hand, the red beam stays in view in the steam area and bends out of vision in the water area. Water level is indicated where red and green colors meet. Mirrors project the image to the operating floor.

USE OF PRESSURE GAGES

Pressure gages indicate liquid level when they are fitted with the correct scale. When adjusted to take care of pressure drop, a gage can be installed on the pipeline some distance from the tank. The operating element, consisting of a bourdon tube, metallic bellows, flexible diaphragm or mercury chamber, can be actuated by the liquid pressure or by air pressure sufficient to balance the liquid head. Fig. 11 shows a simple indicator consisting of a low-reading pressure gage, hand-operated air pump and necessary piping. Gage dial can be calibrated in feet or gallons. The pump fills the pipe with air at sufficient pressure to overcome liquid head and excess air leaks out at lower end of submerged pipe. Pressure acting on the gage is equal and corresponds to the pressure from liquid surrounding the pipe.

The boiler-water alarm, Fig. 9, uses two pipe loops connected to the water column. One end of each loop terminates near water-column bottom. Ends *A* and *B* terminate at the high- and low-water level respectively. Actuating alarm is divided into three chambers by two bellows. Top chamber contains steam supply to operate the alarm; middle chamber receives pressure from top of loop *A*; and bottom chamber connects to loop *B*. With both pipe ends *A* and *B* under water or out of water, pressures in middle and lower chambers are equalized and spring tension opens the steam valve to signaling device.

Liquid-level indicators described here are simple and easy to install. They give adequate service except when operation requires automatic control or transmitting indications to a distant central point. The next article covers instruments for this use.

ACKNOWLEDGMENTS — I

For material used in preparing this section POWER is indebted to Automatic Control Co, Bender-Warrick Corp, The Bindicator Co, Corning Glass Works, Diamond Power Specialty Corp, Ernst Water Column & Gauge Co, Foster Engrg Co, General Controls Co, Paul B Huyette Co, Johnson Corp, Johnson Service Co, O C Keckley Co, J E Lonergan Co, Lunkenheimer Co, McAlear Mfg Co, McDonnell & Miller, Mercoid Corp, Penn Electric Switch Co, Photoswitch, Inc, Reliance Gauge Column Co, Ruggles-Klingeman Mfg Co, Fred H Schaub Engrg Co, Williams Gauge Co, Yarnall-Waring Co. See additional listings on pages 72 and 86.

Primary Elements

Transmitting indications and controlling the level of a liquid require more complex systems than those just described. We need a primary element that actuates a recorder through a telemetering circuit or an automatic valve through a telecontrol system. Let's look first at the individual elements before considering the connecting system.

The primary element, a pickup that actually transfers the level to a transmitting device, consists of a *float, pressure dome, pressure bulb, air bubbler, series of electrodes, capacitor* or *differential-head meter.* These can be either (1) mechanical or direct connected (2) arranged for remote transmission — electrical, hydraulic or pneumatic. Direct-connected units have the indicating and actuating mechanism integral with the primary device, which requires placing the instrument immediately adjacent to the vessel.

Floats are widely used to record and control liquid level in boilers, reservoirs, elevated tanks and supply wells with practically every kind of control. The unit in Fig. 1 moves a steel plunger up and down inside a sleeve. A powerful magnet outside is attracted as plunger moves upward.

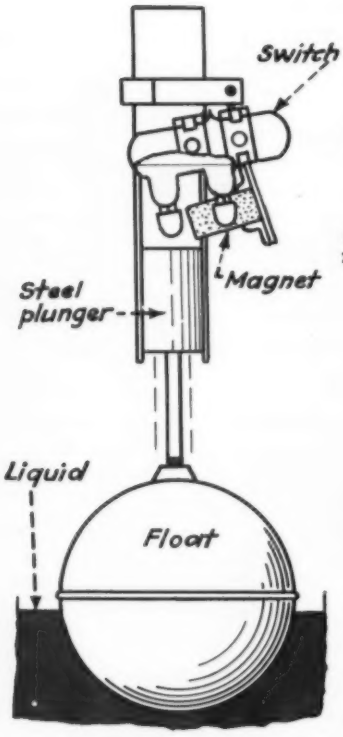
Another design places the float directly in the flow stream, Fig. 2. Here the float moves an iron core inside a pair of impedance coils to unbalance a twin pair of coils in the indicator or controller. This method controls liquid level in a vessel by connecting one float element to the vessel inlet and the other to the discharge. Unbalanced flow operates master controller to adjust level.

Allowing for the liquid's specific gravity, there is a direct relationship between the pressure at any point below the surface and the depth at that point, and the pressure is a measure of liquid height above that point. Head pressure therefore measures the quantity of liquid in open vessels or tanks.

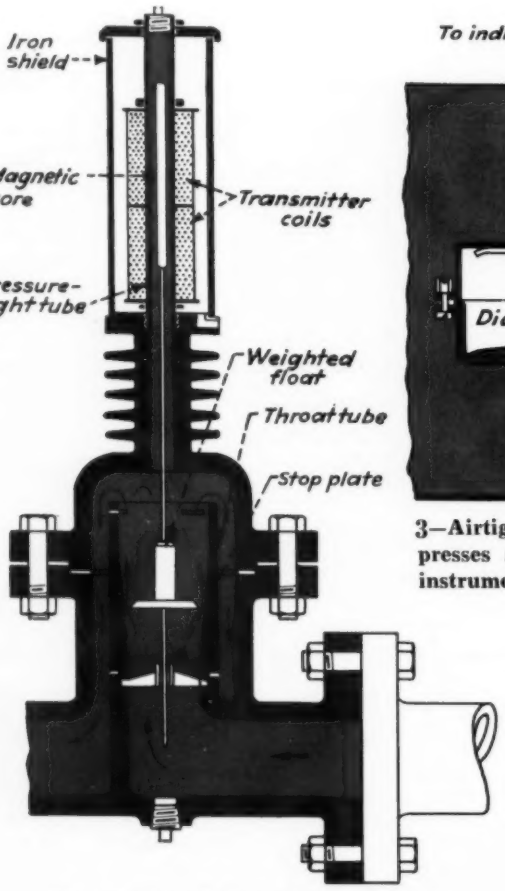
The bellows-operated indicator, Fig. 4, uses a pressure dome located under the liquid. Air trapped in the dome, tubing and bellows is subjected to the liquid head pressure. As liquid level increases, the air is compressed until its pressure equals liquid head.

A pressure-bulb gage, Fig. 3, consists essentially of an air-tight pressure bulb connected by an air-filled tube to a pressure measuring instrument, which may be recorder, indicator or controller. Pressure exerted by the liquid at the bulb compresses the entrapped air in bulb and tubing, and transmits pressure to the instrument where it is measured in terms of liquid depth.

If the liquid to be measured will injure the diaphragm, an extension, Fig. 6, mounts the bulb above liquid level.

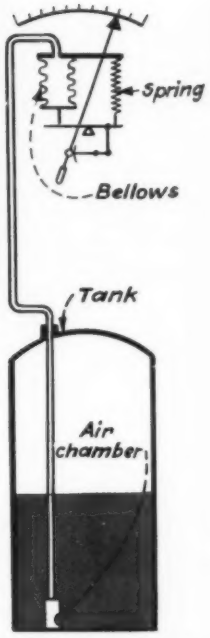


1—Float moves a steel plunger to attract permanent magnet and close the mercoid switch



2—Float and iron-core movement unbalances impedance-coil circuit

3—Airtight diaphragm compresses air in tubing and instrument as level rises



4—Air trapped in lower dome exerts pressure on bellows equivalent to the liquid height in the vessel under measurement

This makes a combination pressure-dome and pressure-bulb instrument and the dome air must be replenished occasionally.

The unit in Fig. 7 is a diaphragm-operated mercury switch for use on bulk materials, semi-liquids and liquids. It serves as an indicator or automatic control for conveyors, elevators, feeders, pumps and weighing devices.

The bubbler gage is particularly well suited for liquids carrying solid matter. A small amount of air flowing into a pipe lowered into the liquid displaces liquid in the pipe. A gage measures the air pressure, and records it in terms of liquid level. The unit in Fig. 5 utilizes a mercury U-tube. Compressed air held at constant pressure by the regulator flows through the sight-feed glass on its way to the liquid reservoir. Height of water above the measuring pipe *A* determines the rate of bubbling, which in turn controls air pressure in the gage line. This pressure acting on the mercury U-tube indicates the liquid level.

A modified differential-pressure instrument, Fig. 8, serves when the contained vapor will not condense in ordinary chambers or when the liquid in the piping is volatile or sluggish at atmospheric temperature. A small flow of air or gas from *A* prevents vapor entering the top connection and liquid entering the bottom one. Pressure in upper line equals vessel pressure whereas pressure acting on lower line is that in the vessel, plus liquid head. Difference is indicated in terms of liquid level. Frequently volatile or corrosive liquids or those containing suspended matter clog or coke the meter piping. Here the liquid purge system that injects cleaning liquid into the piping helps.

IMMERSION ELECTRODES

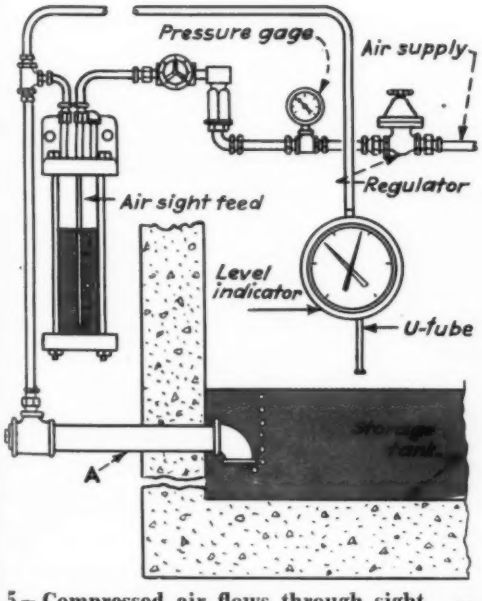
The immersion electrode device, Fig. 9, page 70, consists of an *A*-shaped relay with a laminated core. Primary coil *X* is wound on the upper bar of the core and a secondary coil, *Y*, on the lower bar. An armature lying below the core legs connects to an insulated arm carrying two contact arms. When the armature is raised these arms close or open the motor and electrode circuits, depending upon whether the contacts are normally open or closed. The holding-circuit switch *A* closes the circuit between the two electrodes, causing the longer electrode to become an extension of the shorter. Switch *B* closes the circuit to an indicator, alarm or control.

When alternating current is connected to terminals 1 and 2, primary coil sets up a magnetic flux which, following the lines of least resistance, circulates through the shortest path or through the bar of the lower coil. This flux induces a voltage in the secondary or electrode-circuit coil, but no current flows unless the circuit is closed.

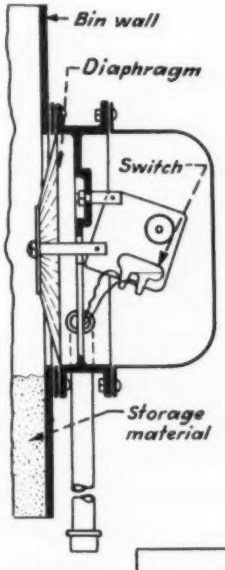
Closing of the secondary circuit, which occurs when liquid reaches the upper electrode, sets up a bucking action in the lower bar of the core because current then flows in this circuit. This bucking diverts magnetic flux to the core legs to raise the armature. .

The capacitor transmitter, Fig. 10, consists essentially of a vacuum tube and relay assembly and capacity pick-up. The vacuum tube, maintained in an oscillating condition, generates high-frequency alternating current. The pickup condenser changes its capacity upon the approach of a liquid. Liquid level itself may form one plate of the condenser whose capacity changes as a result of varying the distance between, or the mutually exposed surfaces of, the plates. In another arrangement the capacity changes because of liquid entering the field of a 2-plate condenser.

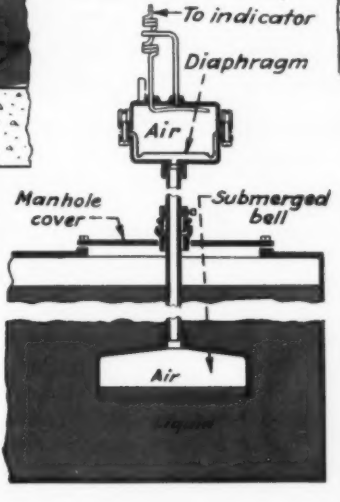
The gage-glass pickup consists of a bakelite body, about 2 in. square, containing the resonator, and two separable cylindrical plates—a ground plate and a sensitive plate These plates



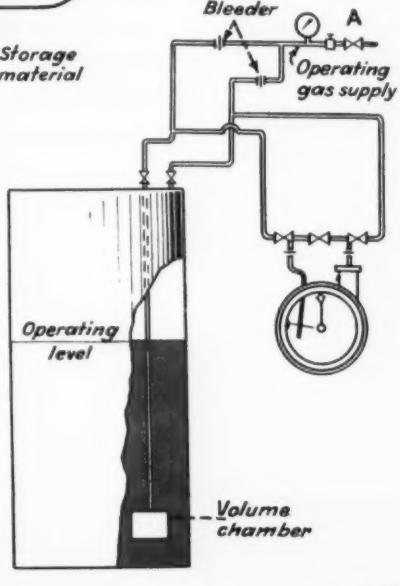
5—Compressed air flows through sight glass on its way to the reservoir. Liquid level determines resulting pressure



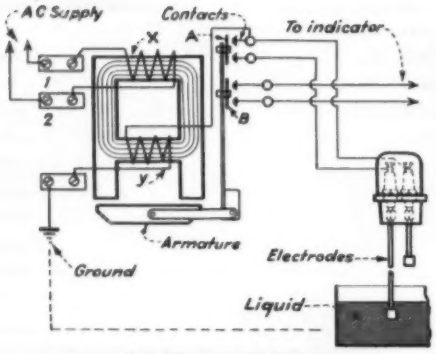
7—A diaphragm-operated mercury switch serves for bulk materials or for liquids



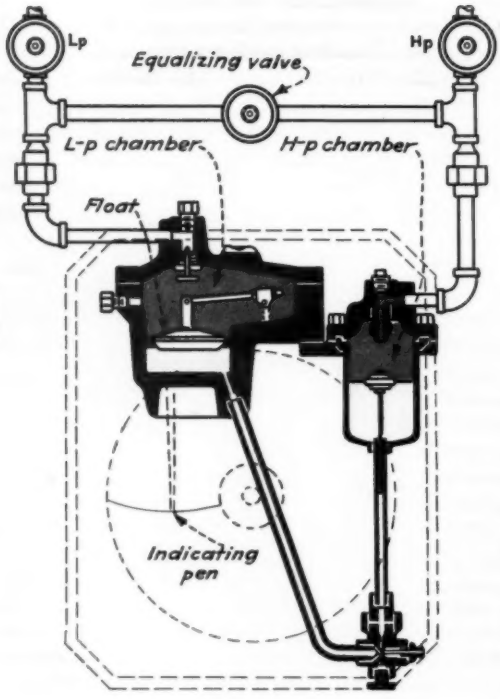
6—A pressure dome protects sealed diaphragm against liquids that damage it



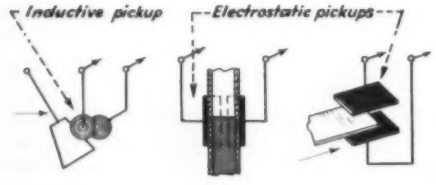
8—Differential-pressure meter modified for liquid vapors that do not condense in usual chambers

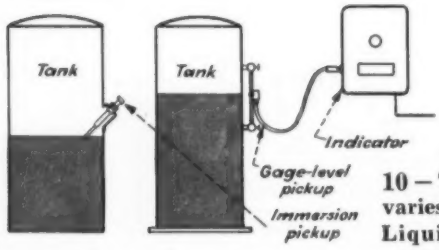


9 — Liquid contacting upper electrode short-circuits coil Y. Magnetic flux lifts armature

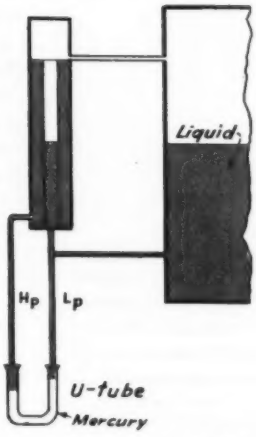


11 — Mercury level in L-p chamber moves with liquid level to shift float which indicates and regulates inflow through controls





10 — The inductive or condenser capacity varies with liquid level in this instrument. Liquid can act as one condenser plate



12—Keep legs of differential-head instrument at same temperature to minimize the effects of changes in specific gravity

clamp to the glass with a thumb screw.

Differential head instruments operate on the U-tube principle, as flowmeters do. Indications are obtained by transmitting a variable liquid head to the primary device's low-pressure side and maintaining a fixed liquid head on the high-pressure side by a special piping arrangement. Differential pressure of the two heads measures the liquid level in open vessels or those under static pressure; static pressure cancels out in the two legs. Instruments of this type employ a proprietary fluid, diaphragm, bellows or mercury manometer measuring element.

TEMPERATURE DIFFERENCES

Because these manometers operate under differential head, a difference of specific gravity in the liquids of the two legs causes inaccurate indications or control, which must be compensated for in some manner. The piping scheme in Fig. 12 and 13 serves to minimize or eliminate the effect of specific-gravity variations between the two legs caused by temperature differences. Here the temperature of the high-pressure leg is kept about the same as that of the low-pressure by extending one tube up inside the other. To make the system fully effective, outer chamber must be completely insulated.

Filling both legs with a suitable sealing liquid keeps them at the same density but correction must still be made for any difference between the specific gravity of the filling liquid and that in the vessel.

Under this condition the two legs of a mercury manometer can be balanced by adding more mercury to the low-pressure leg. But this method does not permit zeroing and checking the meter in the customary manner because additional mercury has been added. Some manufacturers provide a sensitivity slider on the float arm to cancel difference in density mechanically, by sliding the connecting lever in a slot until arm travel is multiplied in exact ratio to the difference in densities.

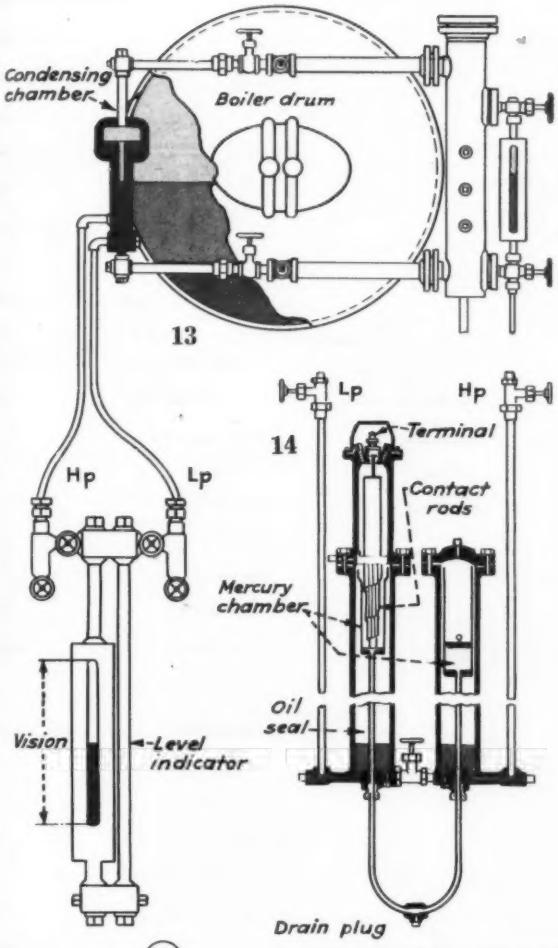
Operation of differential-pressure liquid-level primary elements can be followed by studying the mercury manometer, Fig. 11, with boiler connections as in Fig. 13. At minimum water level fixed head has depressed the mercury level in the high-pressure chamber and raised it in the low-pressure one. As vessel level increases, mercury is forced from the low-pressure into the high-pressure chamber until the difference in head, between that in the vessel and the fixed head, is exactly balanced by the difference in the mercury column.

For a change from zero to full level, metal float moves the pen or controller arm through its full scale. The transmitter in Fig. 14 eliminates the float and necessary levers by permitting the mercury to rise and contact a helix-arranged series of resistance electrodes to vary the electrical resistance of the transmission circuit.

U-TUBE UNIT

The U-tube unit in Fig. 13 contains a colored proprietary liquid and is piped to a special chamber connected to the water column. As the water level rises or falls, a difference in hydrostatic head occurs in the two legs. This pressure, counterbalanced by the special fluid, shows up as a change in level.

The units in Fig. 15 and 16 utilize a bellows that positions itself according to the pressure differential between the two vessel connections, one tap connecting inside the bellows and the other outside. Controller pilot valve in Fig. 15 is attached to the instrument

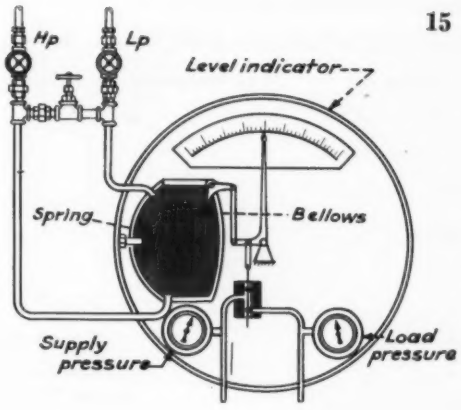


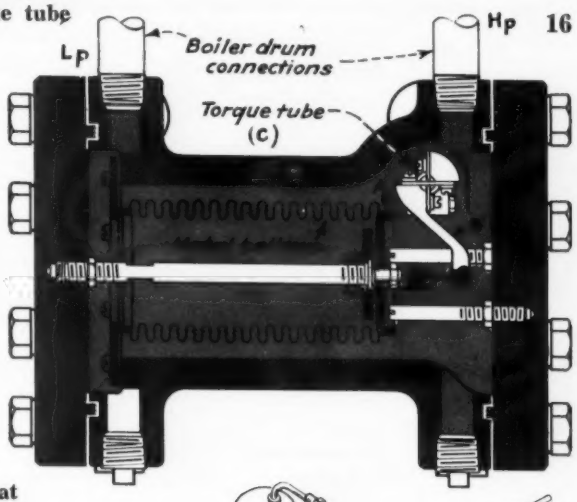
13 — Proprietary liquid takes place of mercury in this U-tube indicator

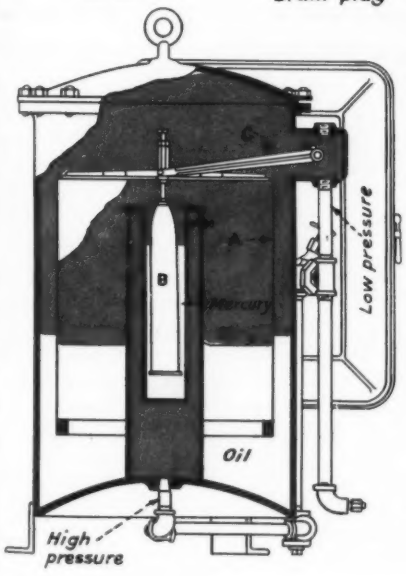
14—Here mercury, instead of moving float, contacts a helix resistance

15 — Differential-head device that uses a bellows to operate controller

16 — Single bellows arrangement to move indicator by a torque tube

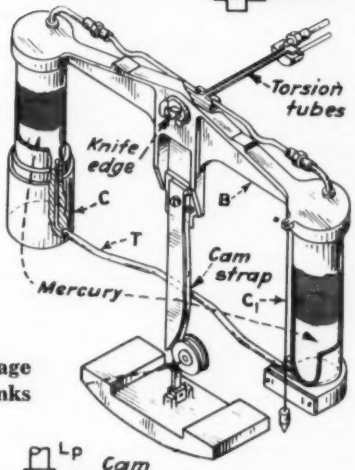


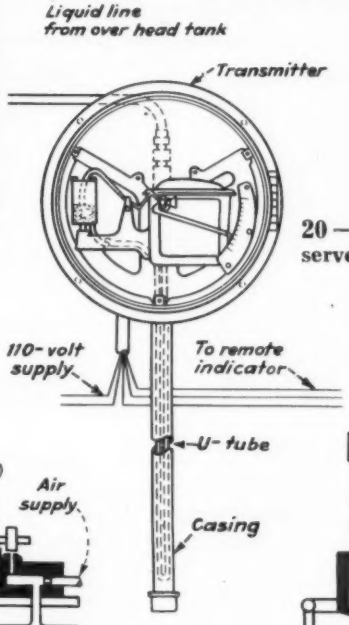




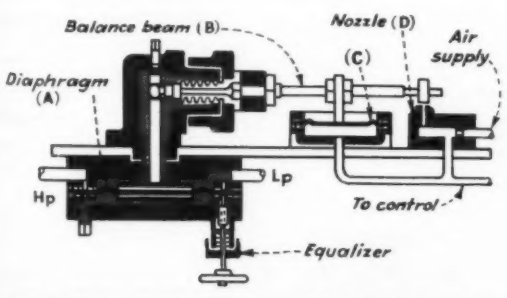
17 — A low-pressure unit that controls either liquid or gas

18 — Mercury-weight difference in legs positions a beam

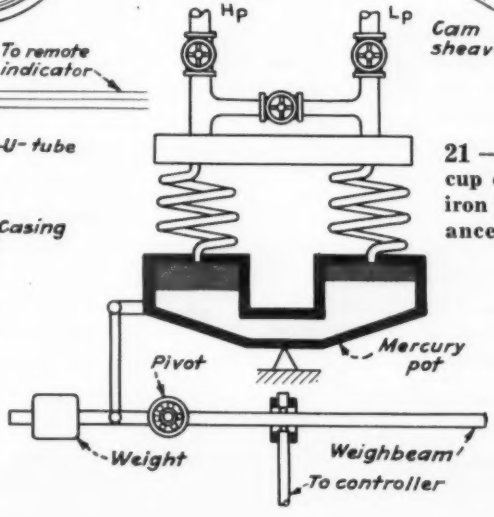




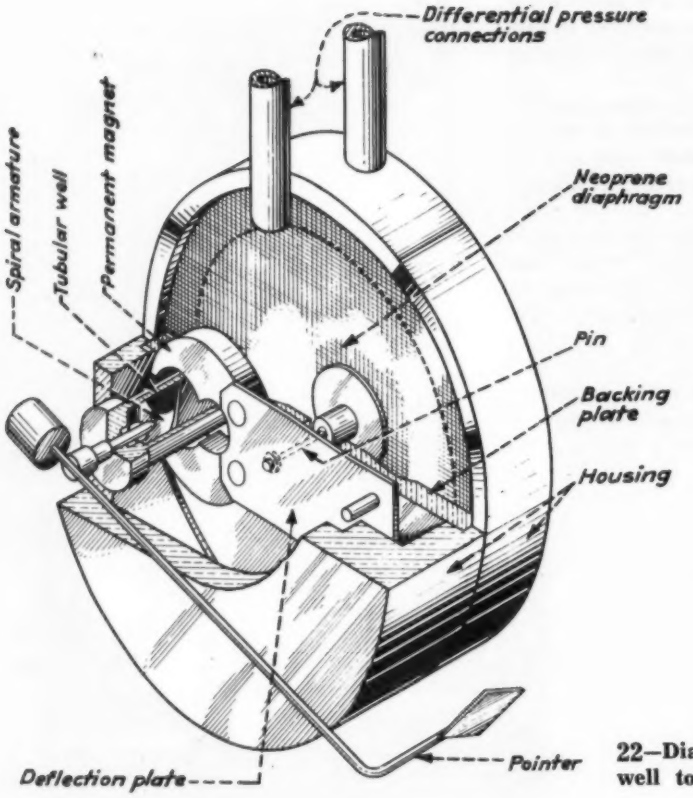
20 — Counterpoise gage serves overhead tanks



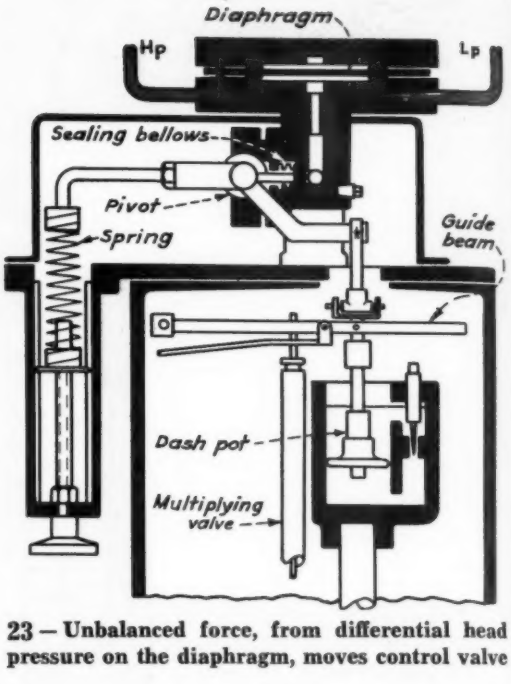
19 — Main diaphragm moves to throttle nozzle output; is rebalanced by reaction diaphragm



21 — Tilting mercury cup consists of a cast-iron pot delicately balanced on a fulcrum



22—Diaphragm moves a magnet along a tubular well to rotate a spiral-strip armature inside



23 — Unbalanced force, from differential head pressure on the diaphragm, moves control valve

pointer. A yoke fastened to the bellows in Fig. 16 connects to a lever through a flexible strip. Other end of lever clamps to the free end of a 3-element torque-tube that seals the manometer chamber. Movement is transmitted through torque-tube center shaft to a pointer on the other end. When differential pressure increases, free end of bellows *A* moves to the left, rotates lever *B* and twists torque tube *C*.

Beam-balance scales or tilting-mercury cup instruments, Fig. 18 and 21, operate on the unbalanced weight of mercury in the two ends. In Fig. 18 the mercury wells are two cylinders *C* and C_1, connected at their bottom ends by tube *T*. At their top ends the cylinders connect to a beam *B* supported at its center on a knife edge. Cylinder C_1 connects to the high-pressure and *C* to the low-pressure tap on the vessel. Changes in liquid level move mercury from one chamber to another and tilt the beam *B*.

Unit in Fig. 21 consists of a large cast-iron U-tube partially filled with mercury and delicately balanced on a fulcrum. Position of the sliding weight determines the liquid level that regulator maintains. When liquid level changes, mercury flow unbalances the chamber so that it tilts on the fulcrum.

Differential-pressure instruments also measure and control liquid level in elevated tanks at atmospheric pressure. Here one chamber opens to atmosphere. The mercury counterpoise gage, Fig. 20, one of these devices, can be connected to the discharge pipe at any convenient location at the bottom of the tower. While the total water head above that point acts on the gage, only the depth of water above the tank bottom is recorded on the chart. Pressure effect of water in the standpipe is balanced or eliminated by the mercury counterpoise.

The low-pressure unit, Fig. 17, serves for either liquid or gas. Differential pressure causes bell *A* to move up or down to a position where buoyancy change of displacer *B* in the mercury balances the change in differential pressure. Bell movement is transmitted by a forked lever *C* to a spindle having pressure-tight bearings.

Although constructed of light material, diaphragm elements are suitable for high-static-pressure vessels because the diaphragm is subjected only to the differential pressure. In Fig. 23 unbalanced force on the diaphragm rotates the seal assembly on its pivot against the adjustable loading spring to move the regulator valve.

The element, Fig. 22, utilizes a neoprene diaphragm to actuate the indicator. A beryllium spring connected to the diaphragm carries a specially designed horseshoe magnet that straddles a thin-walled tubular-well sealing chamber. Inside the tube is a spirally formed strip armature mounted on jeweled bearings that carries the pointer. Magnet movement along the well axis causes armature to rotate.

Diaphragm device in Fig. 19 operates like a weigh scale. Differential pressure applied to main diaphragm *A* is transmitted through push rod and balance beam *B* to the reaction diaphragm *C*. A tip mounted on the beam throttles compressed-air leakage from a nozzle *D* downstream from a restriction orifice. Motion of throttle tip varies the air pressure under reaction diaphragm and in the control piping.

Any of the aforementioned devices can be adapted to control the operation of regulating valves described next.

ACKNOWLEDGMENTS — II.

For material used in preparing this section POWER is indebted to Bailey Meter Co, The Bristol Co, Brown Instrument Co, Builders-Providence Inc, Cochrane Corp, Davis Regulator Co, Fischer & Porter Co, Foxboro Co, Grove Regulator Co, Leeds & Northrup Co, The Liquidometer Corp, Mason-Neilan Regulator Co, Republic Flow Meters Co, C G Tagliabue Mfg Co, Taylor Instrument Cos, Wheelco Instrument Co. See additional listings on pages 67 and 86.

Regulating Valves

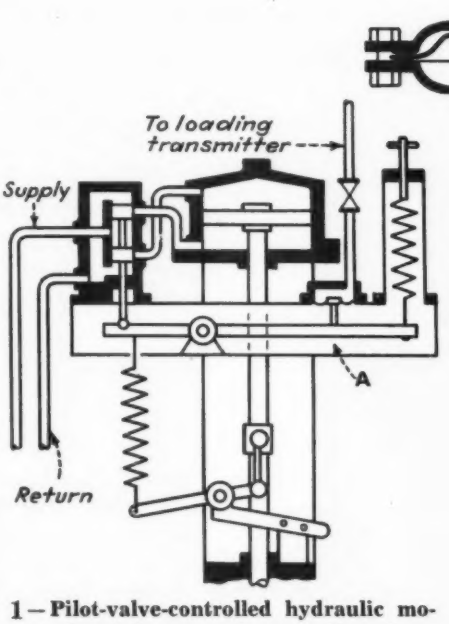
Before selecting the valve for a specific job consider the character of control desired and the conditions under which the valve must operate, as follows:

(1) Which motor will furnish best operating power — hydraulic-piston, Fig. 1; bellows, Fig. 2; or diaphragm, Fig 3? (2) Shall controlled medium be turned on or off if valve operating power fails? This determines whether a direct-acting valve—one opened by its spring or weight—or a reverse-acting type—one opened by its power motor—will serve best. (3) Is inner-valve construction to be butterfly or globe design? If globe, does the job require a single- or double-seat unit?

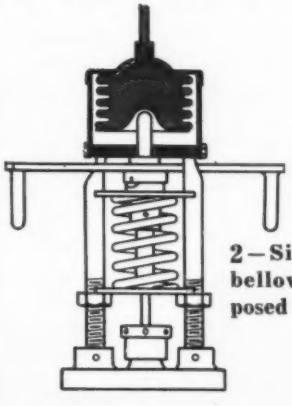
Mechanical operating power comes from liquid or gas supplied through a control pilot at a variable pressure directly related to primary-element position. Hydraulic-piston motors usually furnish power in two directions while bellows and diaphragm units, generally single-acting, must be opposed by a spring, Fig. 4, or weight, Fig. 5, that powers the valve in the opposite direction. We will discuss only the diaphragm operated unit because bellows and diaphragm motors operate similarly, each consisting of a balanced set of equal and opposing forces — a compressed spring or weight opposed by a diaphragm or bellows having a given area and unit of applied pressure. A change in air pressure, plus or minus, moves the valve stem.

Both spring and weight loading have advantages, but valve design and the service it is to render determine the choice. Spring loading is constant only at a given compression; the tighter a spring is compressed the more power it exerts. A spring-loaded valve gives its best performance when flow is constant; a variable demand that requires numerous valve positions changes the spring loading at each new flow. Weights are preferable under some conditions because effective loading remains constant regardless of position.

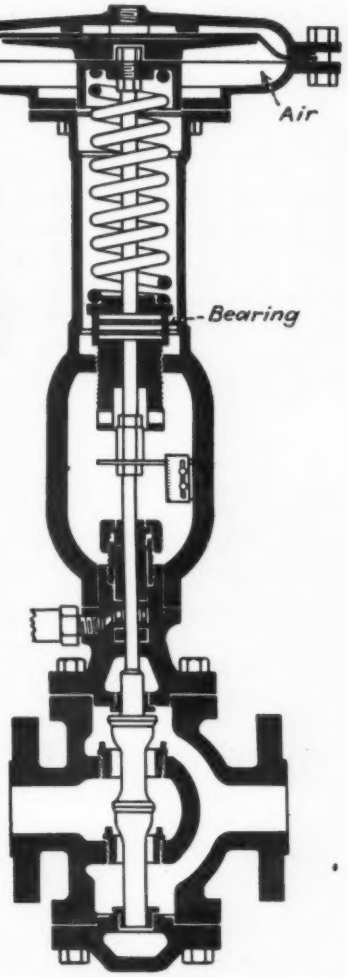
Diaphragm power is absorbed by raising the weight or compressing the spring, overcoming friction and resisting unbalanced load thrust. Motor must have a large margin of power so that these outside influences do not cause unwanted valve movement. This means a large diaphragm with a correspondingly powerful spring. The unit in Fig. 4, page 74, uses a roller-bearing spring-adjusting button *A* to prevent transmitting torsional movement of the spring to the valve stem and increasing its friction. Roller guides *B* keep the stem aligned.



1—Pilot-valve-controlled hydraulic motors furnish power in two directions



2—Single-acting bellows uses opposed load spring



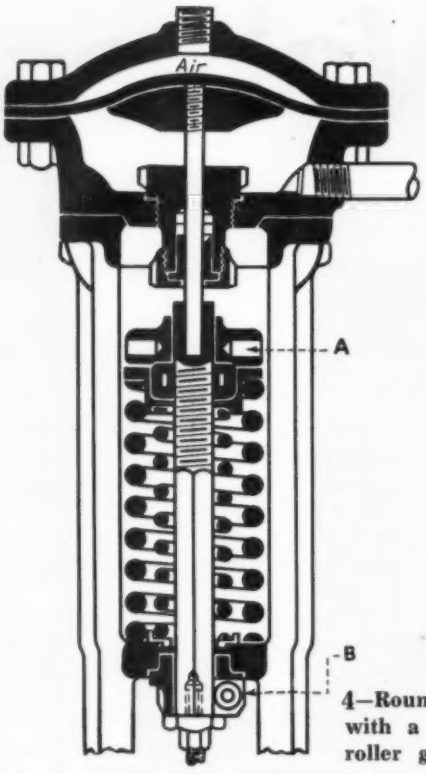
3—Flat diaphragm, loading spring produce movement in two directions

DIAPHRAGM CONTRUCTION

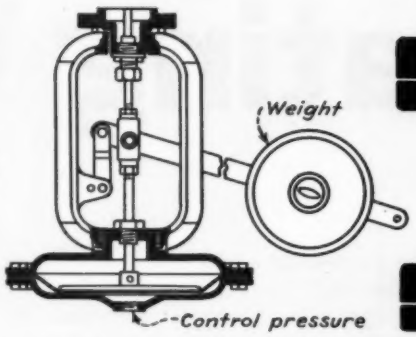
Diaphragms, usually of natural or synthetic rubber, have fabric inserts and may be flat disks or predetermined shapes, molded for maximum flexibility. Shapes vary; Fig. 3 and 5 fit flat diaphragm plates and Fig. 4, a rounded one. To produce maximum power throughout valve travel, diaphragm must remain in full contact with the moving plate, Fig. 7, *A*. Stretching or bowing away from the plate, Fig. 7, *B*, decreases the effective area as travel increases.

Frequent grinding of valve seats or incorrect adjustment of valve-stem length may cause separation that decreases power output sharply just when spring force is greatest. This means that a unit in pressure increase makes the valve travel farther at the beginning of its stroke than near the end and valve travel is not proportional to diaphragm pressure throughout full stroke. Unless diaphragm power is restored by applying a higher operating pressure valve remains incorrectly positioned.

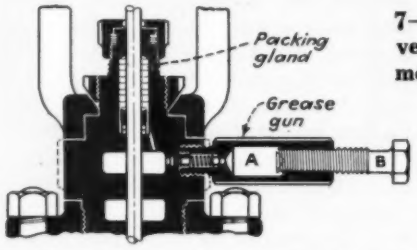
Most important characteristic of a diaphragm motor is its hysteresis: fail-



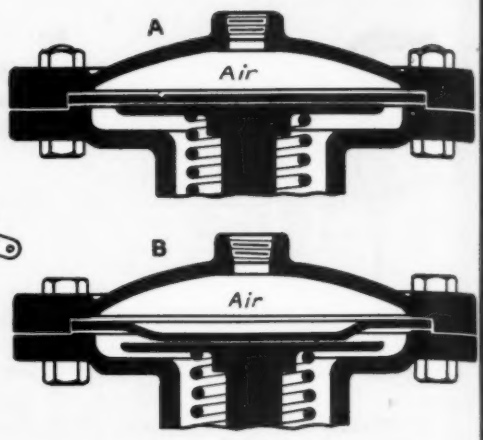
4—Rounded diaphragm head with a loading spring and roller guides for the stem



5—Weights give constant effective load in any position

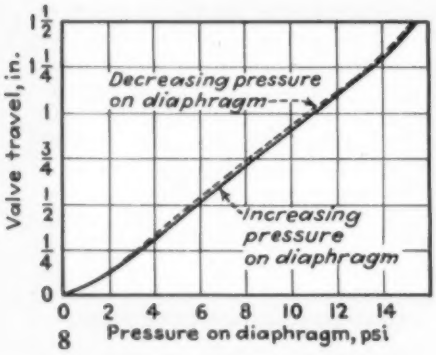


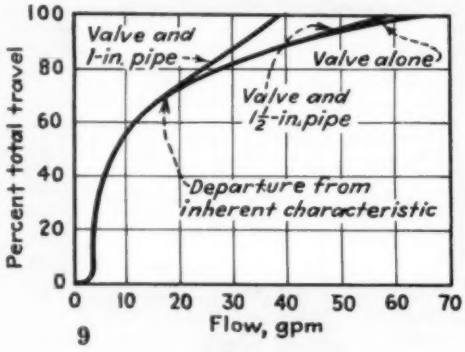
6—Jack screw and grease pocket permit easy stem-guide and packing lubrication. Grease seals against leakage

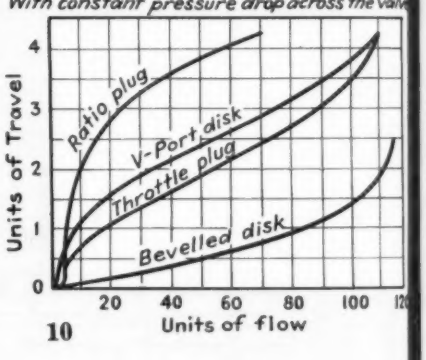


7—To insure maximum power over valve travel, diaphragm must remain in contact with moving head as *A*, instead of bowing away, *B*

8—Stem travel for pressure change on diaphragm. 9—Flow-lift of 1-in. ratio-plug valve with 30-ft. pipe. 10—Flow-lift characteristics of different designs of inner valves







ure of the valve stem to assume the same position for the same motor pressure on upward and downward strokes. Distance between the increasing- and decreasing-pressure lines, Fig. 8, in terms of percent of full travel, is the hysteresis. It accumulates from spring and diaphragm hysteresis, and stem guide-bearing and stuffing-box friction. Excessive hysteresis produces a wide loop, Fig. 16; tight packing alone may account for 10%. Both curves indicate linear relation between diaphragm pressure and stem movement when diaphragm remains in full contact with the plate throughout its stroke.

Automatically operated valves have cast-iron or bronze bodies for lower temperatures and pressures, and alloy-steel ones for high pressures and temperatures. Trim may be cast iron, bronze, monel, stainless steel, or any suitable material which can be cast, machined or ground to suitable shape. Where erosion is serious, stellited seats and disks find use; and hard stainless steel serves where both erosion and corrosion are bad.

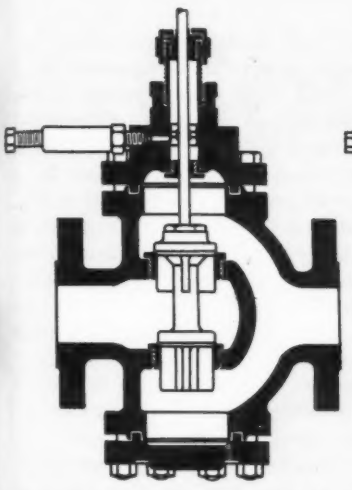
Diaphragm valves are roughly classified as (1) quick opening (2) gradual opening (3) full throttling. The quick opening may be either bevel seated or low-lift V-port type. The gradual opening may be either high-lift V-port or parabolic type — ratio plug and throttling.

Beveled-disk, Fig. 11, or rectangular-port, Fig. 15, valves serve on simple, high sensitivity, small time-lag applications usually for open-and-shut service. With stable load and constant line pressure they operate satisfactorily between 10 and 90% opening. However, they do not suit applications that require flow graduated to correspond to the load. Here the need is for *characterized* valves, Fig. 12, 13, 14 and 18.

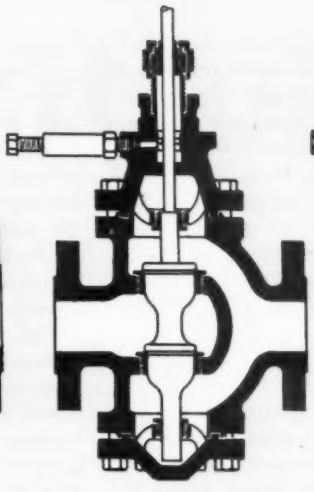
Assume a beveled-disk valve controlling a load that requires ten units of flow, Fig. 10. If the valve lifts 1/10 of a unit, flow changes eleven units or 110% of original. Now suppose the valve supplies a flow of 40 units. Taking the same deviation as before (1/10 unit change in lift) flow changes only nine units, or 22% of the original.

Obviously this places an unnecessary burden on the primary element if it is to maintain a constant level regardless of load. Characterized valves — ratio plug, Fig. 12, V-port Fig. 13, and throttle plug, Fig 14 — suit applications with changing loads because they most nearly approach the ideal characteristic of giving equal percentage increments in flow at equal increments of lift throughout the stroke.

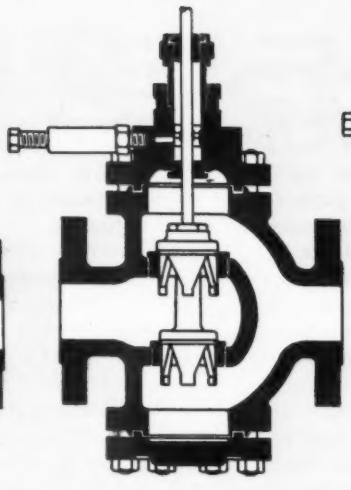
In the ratio-plug valve, Fig. 10, each uniform increment of lift results in a



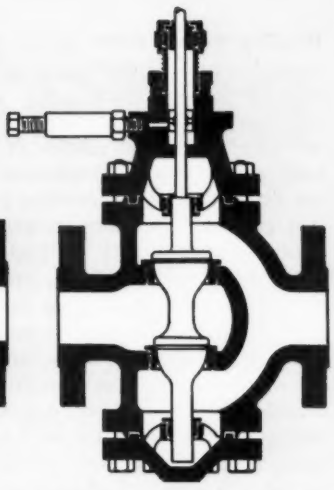
11—Quick-opening, beveled-disk double-seated valve construction



12—Ratio-plug, double-seat valve; stem guided



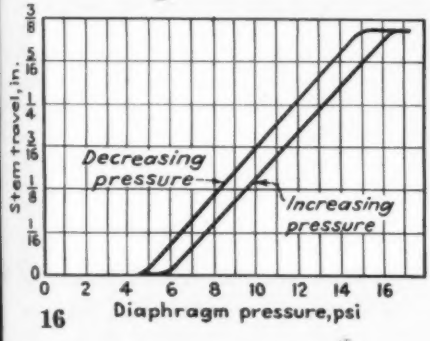
13—Double-seat, V-port valve has highest control range



14—Throttle-plug design resists fouling at low lifts

15—Rectangular-port valves serve on simple high-sensitivity small-time-lag installations for open-shut service

16—Widely separated opening- and closing-pressure lines reveal excessive hysteresis.
17—How valve position affects system head



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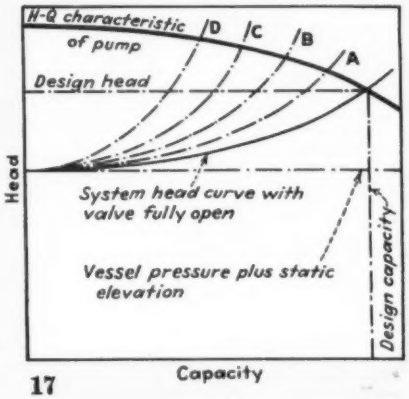

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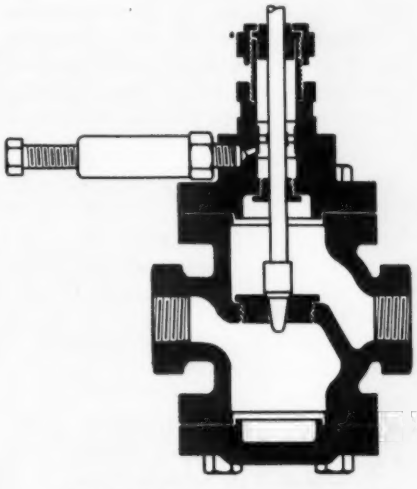


18—Unbalanced thrust is problem in single-seat valves above 2 in.

flow-rate change that is practically a constant percentage of the flow existing prior to each change in lift. It has the lowest capacity of the three throttling types but is recommended for difficult jobs involving large load changes. Having small clearance at low lifts the ratio plug should not handle liquids carrying suspended solids or coking material.

The V-port valve uses a beveled disk carrying a skirt fitted with several V-shaped ports. The V shape and arrangement gives constantly increasing port openings for each unit lift under constant pressure drop. It has the greatest controllable range of the characterized valves and a capacity equally as high as any.

Although similar in construction, the throttle-plug valve gives larger flows at low lifts, Fig. 10, than the ratio plug at equivalent lifts. Developed for applications requiring better characteristics than beveled-disk valves it also serves where resistance to wear is important. Having considerable port area at low lifts the throttle plug does not *coke* or become fouled by suspended solids. It handles large pressure drops particularly well.

Too much stress cannot be placed on the importance of sizing the valve for the service it is to render. When calculating size determine accurately pressure drop actually existing in the system. Never select a valve that gives minimum pressure drop such as is practiced when calculating pipe size. The purpose of a control valve is to create sufficient pressure drop to restrict the flow to that quantity called for by the primary element.

Pressure losses in pipelines vary as the square of the fluid velocity and, in actual practice, the valve will not have constant pressure drop across it throughout full flow range because some of the normal drop is absorbed by lines and fittings ahead of and beyond the valve. Nominal pressure drop across a valve can be completely absorbed by line loss at peak flow, putting the valve and primary element completely out of control. A velocity of 5 ft per sec (for liquids) holds line pressure drop to a reasonable minimum at maximum flow.

Naturally, the valve should not be too small but it is equally important that it should not be too large. If oversized, it operates erratically and the seat and disk are subjected to severe wire drawing because of the restricted opening. Fig. 9 shows the loss in capacity and altered characteristic when using a 1-in. ratio-plug valve (having good characteristics) with 1- and 1½-in. pipe. Beveled-disk, V-port or throt-

tle-plug valves show greater discrepancy because of their greater relative capacities, size for size.

When selecting a valve consider whether it is to be single- or double-seat construction. Single-seat valves are impractical for throttling control if line pressure fluctuates widely unless controller sensitivity is high or the valve small. Above 2 in., unbalanced thrust becomes a problem unless line pressure is low. If pressure drop across the valve is constant, unbalanced load is constant and merely equivalent to an additional spring load opposing diaphragm action. Usually both high and low side pressures vary with a change in valve opening. Turbulence and velocity effects also increase with flow.

SEMI-BALANCED VALVES

Line pressure entering between the seats of a double-seat valve produces a semi-balanced unit and eliminates the effects of varying line pressure to some extent, but they cannot be relied upon to give tight closure. Semi-balancing permits the valve to operate at high-pressure differentials because the diaphragm need not overcome full-line pressure acting on the disk as in a single-seat valve. Even in semi-balanced valves, unbalanced forces are not always negligible.

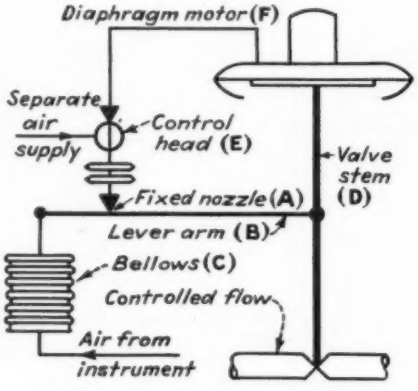
Rate of flow through a regulating valve depends primarily on: (1) area of the valve opening and (2) pressure drop across the valve. If pressure drop is subject to wide variations feeding rate varies widely for a given valve opening. Pressure variations may be caused by pump characteristics, by faulty pump governors or by friction loss in the line. A centrifugal pump always operates at the intersection between its head-capacity-characteristic and the system-head curve; altering the shape of either changes the pump's operation.

A regulating valve changes the system head, curves *A* to *D*, Fig. 17, as it moves toward the closed position. Pump head pressure then varies according to intersection of system-head curve with *H-Q* characteristic curve and influences pressure differential across the regulating valve. Constant pressure drop can be maintained by a differential-pressure-control valve, Fig. 20, installed ahead of each regulating valve, if the former responds accurately to pressure changes. With constant pressure drop, flow is proportional to valve opening, regardless of load changes.

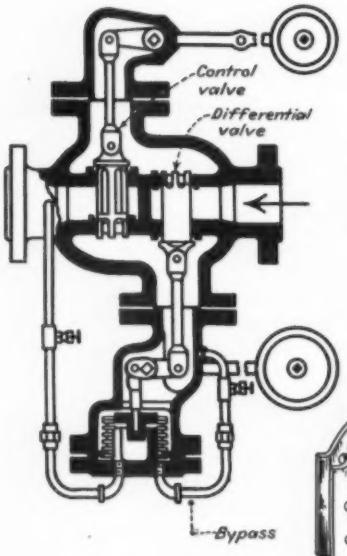
Excessive valve hysteresis or unbalanced thrust may prevent the valve assuming a position that corresponds exactly to primary-element output pressure. Controlled medium then deviates farther until primary element moves and changes the controller pressure sufficiently to set the valve. A valve positioner, Fig. 19, supplied from a separate air source, corrects for this and eliminates hunting. It assures the valve taking a position having a definite relation to primary-element position regardless of outside opposing forces such as packing friction or spring hysteresis.

Here loading pressure goes directly to the positioning device, mechanically connected to the valve stem, that applies higher pressure increments to main diaphragm, based on primary element pressure modified by the valve's actual position. Any displacement of the valve from its correct position acts through the positioner to change diaphragm pressure an exact amount to correctly position the valve.

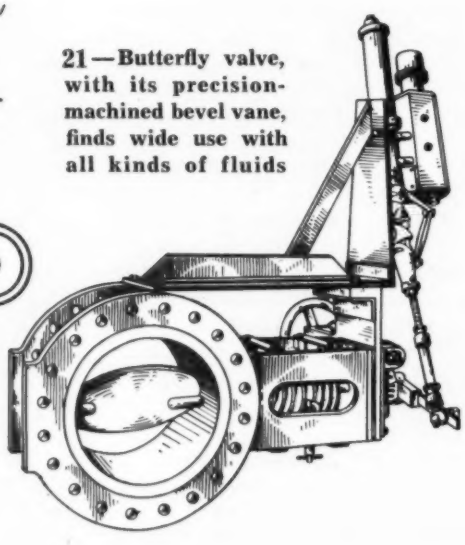
19—Positioner, fed from a separate air supply and mechanically connected to the stem, overcomes hysteresis and positions valve



20—A sensitive differential-pressure valve placed ahead of the control valve maintains a constant pressure drop across latter



21—Butterfly valve, with its precision-machined bevel vane, finds wide use with all kinds of fluids



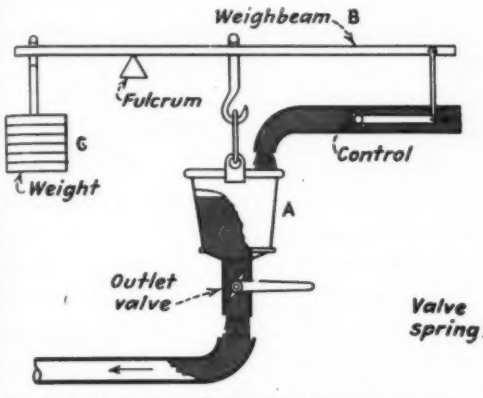
POSITIONER OPERATION

In operation, air discharge from a fixed nozzle *A* is controlled by movement of a lever arm *B* held tangent to it. One end of lever connects to bellows *C* supplied with air pressure from primary element. Any movement of the bellows moves the lever. Other end of lever connects to valve stem *D* and is moved by it.

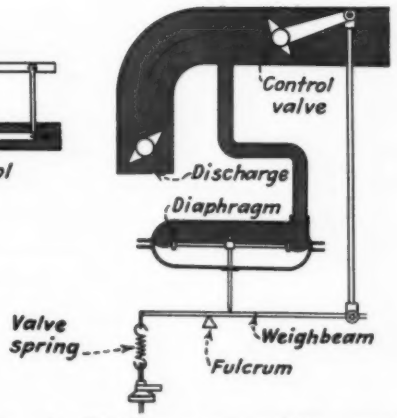
Changes in air pressure from primary element expands or contracts the bellows and moves the lever toward or away from the nozzle. This throttling action on the nozzle operates a control head *E* that readjusts pressure on the diaphragm *F* until nozzle and lever are again tangent. Because air supply comes from an independent source, pressure on valve diaphragm can be greater or less than that acting on the bellows.

The butterfly valve, Fig. 21, built in large sizes, finds wide use in handling fluids of all kinds. The modern unit is precision machined with a beveled vane, set at an angle with the valve body so that it tends to close under pressure drop.

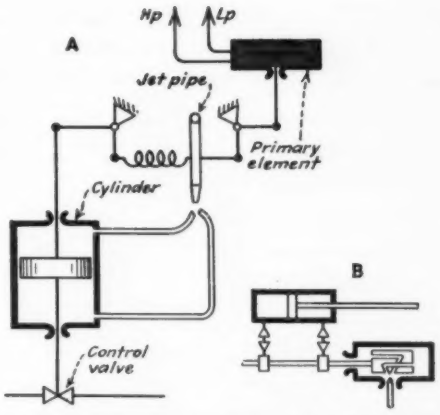
Control Systems



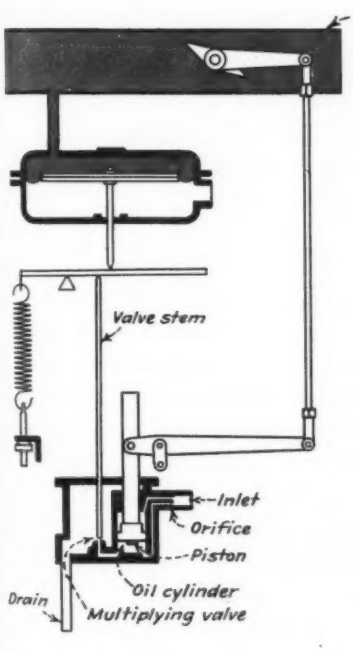
1—Weighbeam remains in balance as long as water weight remains constant



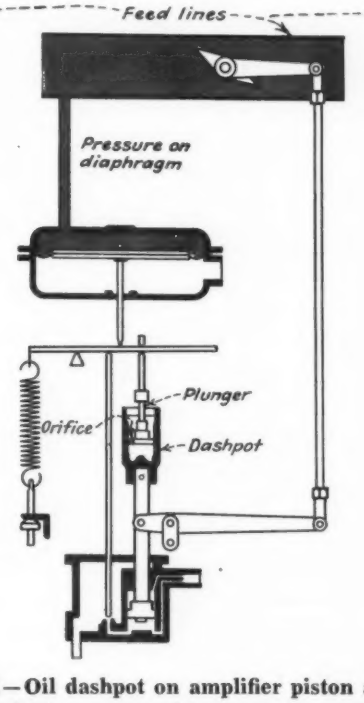
2—Diaphragm opposed by a spring replaces the bucket and weight control



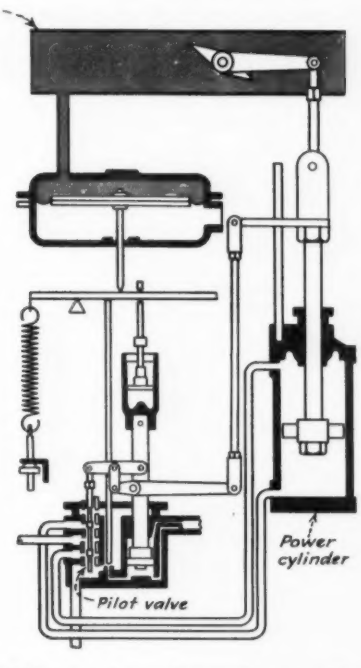
3—Diaphragm moves oil jet between two orifices leading to power cylinder



4—Weighbeam of Fig. 2 regulates oil pressure acting on an amplifier piston



5—Oil dashpot on amplifier piston anticipates pressure's return to normal



6—Adding a relay valve and power piston takes care of large-sized valves

We have discussed primary elements—devices that detect liquid level—and regulating valves—automatic mechanisms that control liquid flow. To complete the control system, connection must be made to a power source so that the primary element can force either a remote indicator to assume a position corresponding to true liquid level or a valve to move and correct change in level. To do this job satisfactorily, the complete system must be sensitive, powerful, stable and rugged.

More specifically, automatic controllers consist of four essential parts: (1) primary sensitive element (2) measuring device that converts primary element response into some sort of indications or recordings (3) controller that converts primary-element position into power impulses, which operate the (4) final control element that varies the flow to meet primary-element detections. In some controllers the first three are not always separate and distinct.

For instance, a liquid-level controller may use a float that connects directly to the supply valve. Here the float detects the level (element 1) and by its vertical position indicates this level

(element 2). At the same time it acts as element 3 to position the supply valve.

Before considering controllers in detail, here are two terms—sensitivity and throttling range—that need defining.

Sensitivity of a controller has no reference to dead zone—level variation that does not affect the primary element—but is expressed broadly as the ratio of a result to its cause. In a pneumatic controller it is the ratio of output-air pressure change to the movement of the primary element or, more simply, the ratio of valve movement to primary movement. High sensitivity results in a large output pressure change for a given movement and, conversely, low sensitivity means a small pressure change for same relative movement.

Although quite often erroneously used to designate sensitivity, throttling range (control band) expresses primary element movement (in percent of its full travel) necessary to cause full travel of the control valve. By widening the range it is possible to get increasingly smaller valve movements for a given deviation from the control point; conversely, narrowing the range gives greater valve movement for a given deviation.

The range can be so small that for practical operating purposes a proportioning controller can be made into a 2-position unit, or the range can be widened so that it takes full-scale movement to put the valve through its full stroke. Widening the throttling range increases the instrument's droop characteristics.

CLASSIFICATION

Control systems can be broadly classified according to the medium that furnishes power for operation as (1) hydraulic (2) electric (3) pneumatic, or (4) combined electric-pneumatic. To better understand the operating principle, study the simple hydraulic system in Fig. 1, page 77.

The problem here is to keep a constant water level. Weight of water in bucket *A* is balanced on weighbeam *B* by weight *C*. Weighbeam remains in a balanced position as long as water weight remains constant, but if discharge-valve position changes, water level varies. Thus weighbeam moves to adjust the control valve. Starting with this impractical device, let us follow the steps necessary to convert it into an actual regulator.

In Fig. 2 the weight is replaced by a spring and the bucket by a diaphragm that supports the static weight of the liquid head. Action is the same as before except that diaphragm pressure is balanced against spring tension. When pressure on the diaphragm increases or decreases, it moves the control valve to restore the pressure to normal. Weighbeam is again balanced. For every control-valve position there is a different weighbeam position and, consequently, a different tension on the spring. Therefore, the regulator does not control at an exact constant pressure or level.

Fig. 4 shows a mechanism that amplifies weighbeam force. Amplifier is a differential piston operating in a cylinder supplied with oil or air under pressure. From the inlet, operating fluid goes to a chamber above the piston and through a restricting orifice to a chamber under the piston. Latter chamber drains through the multiplying valve. Only work imposed upon the weighbeam is that necessary to operate multiplying valve. With the latter throttled, pressure builds up under the piston and moves it upward.

STABILIZING DRIVE

Free flow through multiplying valve reverses the operation, and when weighbeam is balanced (always in a horizontal position) multiplying valve is balanced and amplifying piston remains stationary. This regulator is practical only for systems having no time lag—interval between main-valve movement and change in controlled medium.

In Fig. 5 a stabilizing device takes care of time lag by balancing the weighbeam prematurely to prevent hunting. The device that accomplishes this is an oil-filled dashpot built into the amplifier piston. Dashpot plunger connects to the weighbeam.

Movement of amplifier piston creates a differential pressure across dashpot plunger that momentarily rebalances the weighbeam in anticipation of the controlled pressure's return to normal. Differential pressure is gradually relieved by oil leakage through an orifice in dashpot plunger and force acting on weighbeam decreases, thus preventing regulator hunting. To make the device applicable for any size control valve, a pilot valve and power cylinder must be added.

In Fig. 6, the amplifier piston, instead of moving the control valve directly, now operates a pilot valve. As the latter moves, it uncovers both power-cylinder ports; oil under pressure then flows to one side of the power piston and drains from the other side. Pilot-valve ports are so located that when valve stem is in midstroke both power-cylinder ports are closed and power piston is held stationary.

Obviously, unless pilot valve returns to its midposition at the instant power piston reaches a new control position, the piston would continue and make a full stroke. A restoring lever that connects to the amplifier and power-piston rods controls pilot-valve movement. Amplifier piston moves pilot valve from midposition, whereas power piston always moves it toward midposition.

The hydraulic system, Fig. 3, uses a jet-pipe relay consisting of a nozzle that swings freely on a pivot. Oil discharge is directed at two closely adjacent receiving orifices in the distributor block that connect directly to the power cylinder. Total movement of jet pipe is less than one mechanical degree.

With jet pipe in midposition, equal pressures exist in each receiving orifice and consequently pressure on each side of the power piston is equal. With the slightest movement of the jet pipe, one orifice receives more oil, thereby creating a pressure differential across the piston, which then moves at a rate proportional to jet-pipe deflection.

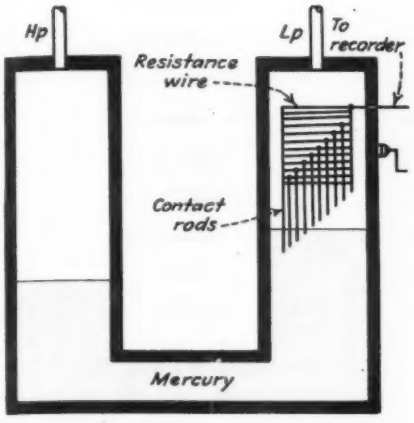
Jet-pipe movement is controlled by primary element and opposing spring *A* which position it to move the valve-operating power piston. On applications requiring large power pistons the jet oil supply and pressure are not adequate. Here an auxiliary piston moves a relay valve to control the power piston *B*. The jet then directs oil into two orifices in relay piston periphery that lead to opposite ends of the piston. Jet-pipe movement to the left forces relay piston in the same direction until both orifices are again equidistant from the jet.

ELECTRICAL SYSTEMS

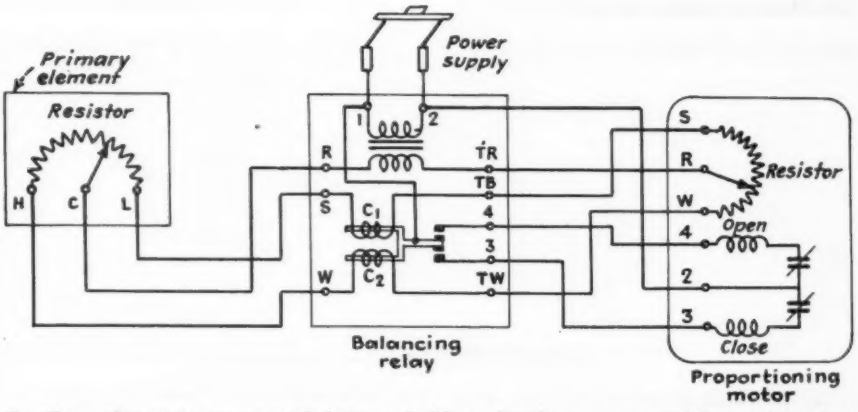
Electrical systems for indication and control of liquid level include series resistance, resistance balance, reactance balance, self-synchronizing motors, periodic-impulse relays and on-off switch operation.

Mercury-manometer transmitter, Fig. 7, contains a graduated resistance in the low-pressure chamber. Resistance wire can be wound in a coil with a series of vertical rods that contact the rising mercury. Or the entire resistance can be contained in concentric rings of individually laid rods cut so that their lower ends form a true spiral contact. When the mercury makes or breaks contact with each rod, current flow in transmission circuit varies to correspond with transmitter mercury position. Receiving instrument is similar to a simple wattmeter.

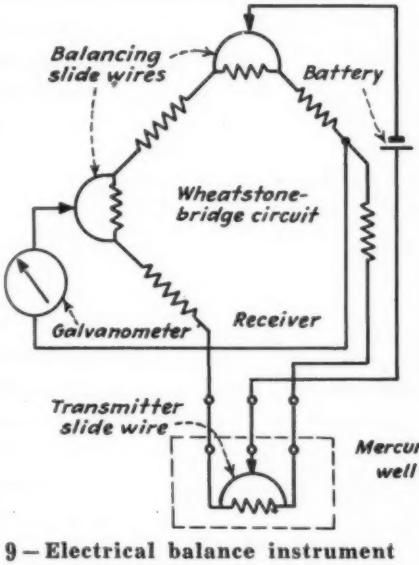
Resistance balance, Fig. 8, uses two rheostats connected into a bridge circuit with a sensitive relay that detects unbalance in the bridge. Relay controls a reversing motor which, as it operates the flow valve, restores the bridge to balance. Primary element



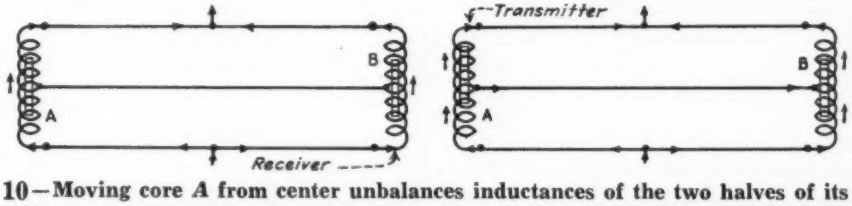
7—Mercury rise and fall varies resistance in external metering circuit



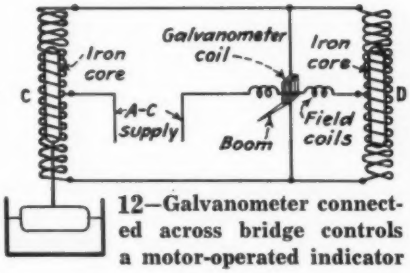
8—Two rheostats connected into a bridge circuit use a sensitive relay that detects unbalance in the bridge to control a reversing motor-operated valve



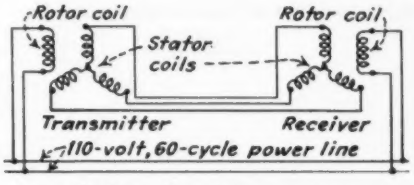
9—Electrical balance instrument employs wheatstone-bridge circuit



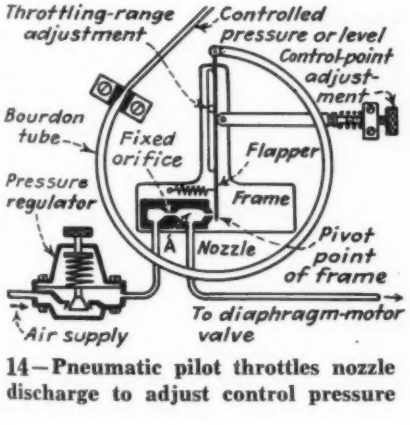
10—Moving core *A* from center unbalances inductances of the two halves of its coil. Current then flows through center wire to move right-hand core *B*, Fig. 11



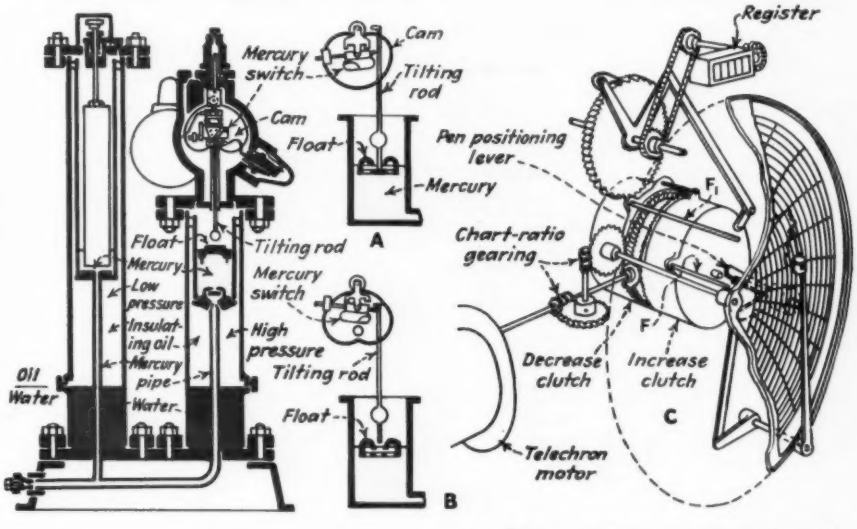
12—Galvanometer connected across bridge controls a motor-operated indicator



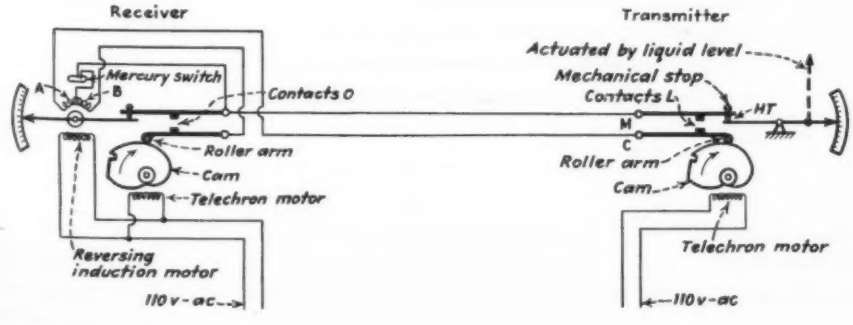
13—Self-synchronizing motors stay locked in step and move in unison



14—Pneumatic pilot throttles nozzle discharge to adjust control pressure



15—Hook rod on mercury float tilts a switch to send electrical impulses operating receiver magnetic clutches



16—Two constant-speed cams close electrical contacts for a time period varying with the position of stop *HT*

movement operates left-hand rheostat.

Another resistance balance unit, Fig. 9, uses a float and counterweight to move the transmitter slidewire. Changes in transmitter slidewire resistance occur with changes in float position. Measurement is made by the electrical-balance method that employs a wheatstone bridge circuit to determine transmitter slidewire resistance in terms of known standard resistors.

Balance-point detector is a galvanometer through which no current flows when resistance of transmitter and standard resistors balance. The receiver can be used with pneumatic system for control purposes.

In one inductance bridge two coils, *A* and *B*, are connected into an alternating-current circuit, Fig. 10, page 79. If an iron core is centered in each coil, current flows only in the two outside wires because the two parallel circuits are then balanced. Moving the left-hand core above the midpoint of coil *A*, Fig. 11, increases the top half of the coil's inductance and reduces it in the lower half. Consequently more current flows in the lower half than in the top. As a result part of the current from bottom half of coil *A* flows through center wire to top half of coil *B*.

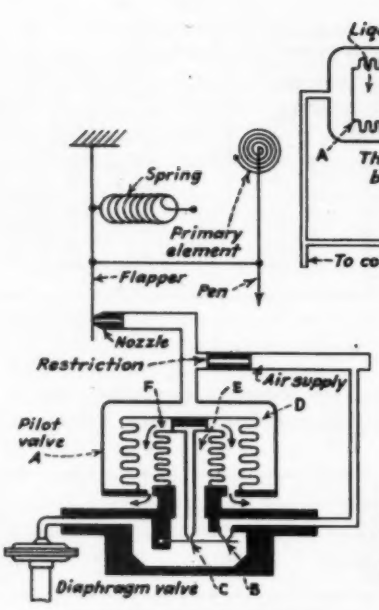
EFFECTS OF UNBALANCE

Top half of coil *B* now has more current flowing in it than bottom half, and exerts a greater pull on the iron core. This lifts the core into the same position as that in coil *A*. After this occurs, circuit is again in balance and current flows in the two outside wires only. From the foregoing it is evident that as core in coil *A* moves up or down the core in coil *B* will take a similar position.

Fig. 12 is another inductance bridge arrangement with power connections made to the center of two coils, *C* and *D*, instead of to the ends. Moving the core up in coil *C* increases the inductance in its top half, and reduces the inductance in its lower half; consequently more current flows in the bottom half of both coils, *C* and *D*, than in the top half.

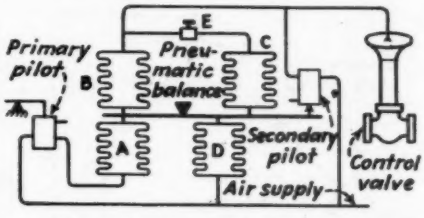
Pull on the core in coil *D* is not depended upon to position the indicator or recorder. This is done by a continuously running synchronous motor through a mechanism actuated by the sensitive galvanometer boom. Varying liquid level changes the position of core in coil *C* and causes current to flow through the galvanometer circuit. Deflection of galvanometer pointer operates a mechanism to position the receiving instrument. When this has been adjusted accurately the core in coil *D*, connected to the receiver, is in position to balance the bridge and the galvanometer boom is at zero.

The system in Fig. 13 utilizes self-synchronizing motors which, when interconnected, operate so that one motor reproduces any motion imparted to the other. The three transmitter stator leads connect to the three receiver stator leads and both rotor leads connect in parallel to the same ac source. Connecting ac power to the motors when the rotors are out of synchro-

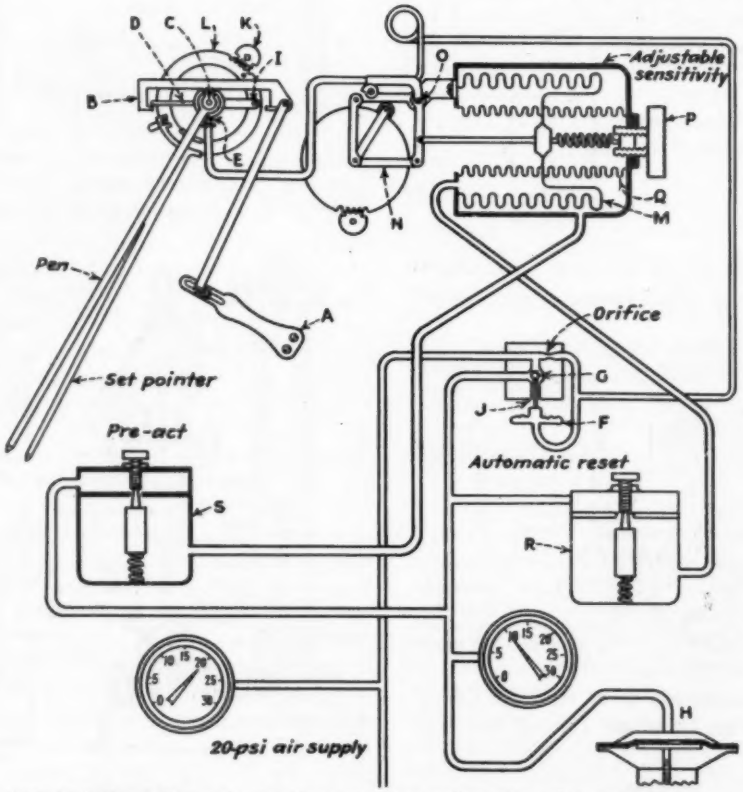


18—Complete pneumatic controller maintains a constant liquid level

17—Multiplying relay fills and empties air control lines rapidly



19—Electrical balance, Fig. 9, operates primary pneumatic pilot



20—Primary element operates recorder and pneumatic controller complete with adjustable sensitivity, preact and automatic reset devices

nism, unbalances the stator voltages and current flows in these windings. Thus a torque is produced in both rotors that tends to keep them in phase. Since the transmitter rotor is held mechanically by the measuring mechanism, the receiver rotor, being free to move, takes a position in synchronism with the transmitter.

The transmitter in Fig. 15 combines a mercury manometer, synchronous motor-driven cam and mercury switch that gives a time period to electrical impulses sent to the receiver. Cam rotates once each minute to move the switch up and down vertically. A hook rod resting on the mercury float is in position to tilt the switch as it moves vertically. In *A*, cam is in neutral position and rod rests on float. When cam rotates to position *B* rod hooks on the switch and tilts it to the closed position. Continued rotation rests the rod on its float and switch tilts back to open transmitting circuit.

Length of time that switch remains closed during each cam revolution depends on height of the mercury in manometer chamber. Between the two extreme mercury positions tilting rod holds the switch closed for a time period exactly proportional to the primary element position and sends electrical impulses of variable duration to the distant receiver.

CLUTCH DRIVE

Receiver *C* consists essentially of a synchronous motor driving two bevel gears in opposite directions, which are alternately engaged by magnetic clutches. Electric feed to the clutches comes from a relay actuated by impulses from the transmitter. When open, the relay energizes the decreasing clutch and, when closed by a transmitter impulse, it energizes the increasing clutch.

Increasing clutch carries finger *F* and decreasing clutch, finger F_1. When either clutch is energized it engages with the proper revolving bevel gear which rotates the drum and carries the attached finger around to contact and move the pen-positioning lever. Upon being de-energized the clutch and finger return to neutral. Angular clutch movement is proportional to the time duration of primary impulses.

The transmitter, Fig. 16, consists essentially of a mechanically operated measuring device; two contact arms, swinging about points *M* and *C*; and a constant-speed cam arrangement to swing the lower contact arm in a continuous reciprocating cycle. Upper arm is positioned by the measuring device through mechanical stop *HT*. Lower roller arms in both transmitter and receiver rise and fall with the rotating cams driven by the telechron motors.

An induction motor provided with shading coils *A* and *B* positions the receiver. Short-circuiting one coil produces rotation in one direction, whereas short-circuiting the other causes rotation in the opposite direction. If both coils are short-circuited or open-circuited simultaneously, no rotation results.

Contacts *L* in the transmitter short-circuit shading coil *A* when the mercury switch is closed, whereas contacts *O* in the receiver short-circuit coil *B*. If contacts *L* and *O* close simultaneously, no rotation of the reversing motor takes place. This means that the transmitter and receiver are in exact relation with each other.

DROP IN LEVEL

If the level decreases, contacts *L* will be closer together than contacts *O* and will close first, short-circuiting coil *A*, causing clockwise rotation of the reversing induction motor until the receiver reads the same as the transmitter. Likewise, if the level increases, the contacts *L* will be farther apart and contacts *O* will close first, short-circuiting coil *B*, causing rotation of the receiver motor in a counter clockwise direction to show a corresponding higher-level reading.

The mercury switch shown in the common line and installed in the receiver unit is closed during the metering operation, but is open during the rest of the cycle. Opening of the mercury switch takes place before contacts *L* and *O* open on the down strokes of the roller arms, thereby preventing arcing or burning at these contacts.

The complete circuit includes a phasing circuit as well as the metering circuit just described. Phasing circuit gives the cams the same angular position after a power interruption to either or both motors, or when first starting up the meters.

Pneumatic systems convert liquid level positions into a proportionate air pressure and transmit it to the receiving instrument or control valve through non-corrosive tubing. Primary element contains an adjustable-discharge nozzle located downstream from a restricting orifice in the air supply pipe. As the liquid level varies, it moves a flapper or other obstruction toward or away from the nozzle to control air discharge from it, Fig. 14.

Any amount of discharge through the nozzle less than that supplied by restricting orifice causes a proportional pressure to build up in outgoing line to receiver or control valve. Because fixed-orifice discharge is constant, pressure in chamber *A* depends on nozzle discharge and can be of any value from zero to maximum.

Long piping between primary element and valve diaphragm (including diaphragm chamber itself) has considerable capacity that introduces a time lag between forward and reverse action. To eliminate this trouble, control elements include a booster pilot valve *A*, Fig. 17, which is nothing more than a multiplying relay that fills and empties the line rapidly.

A neoprene-faced spring-actuated flap controls both the supply port *B* and exhaust port *C*. Nozzle pressure acts on the large bellows *D*, which operates the flap through tube *E*. Transmitted pressure from supply valve *B* acts on inner side of small bellows *F* as well as on the valve diaphragm. Increased nozzle pressure moves large bellows and exhaust tube *E* down to force flap from port *B*.

Decreased nozzle pressure permits the large bellows and exhaust tube to move up and allow flap to close port *B*. When continued upward movement of bellows moves exhaust tube away from flap, entrapped air in diaphragm chamber flows up exhaust tube *E* and out between the two bellows to atmosphere. When transmitted pressure is correct, pilot valve is balanced and flap closes both ports, *B* and *C*.

FLAPPER MOVEMENT

In many processes it is necessary to limit the air pressure changes to small increments in order to give the control valve similar small movements. Because the nozzle flapper normally moves only 0.002 in. to change the system air pressure from maximum to minimum, it is impracticable to get a small fraction of this amount by merely reducing flapper movement. The left-hand bellows *A*, Fig. 18, gives these small increments.

An increase in air pressure going to the control-valve diaphragm also acts on the outside of bellows *A*, Fig. 18. This force is transmitted through the liquid to inside bellows, which moves the flapper away from its nozzle around fulcrum *X* just enough to stabilize the pressure and maintain the valve in its new position. This unit constitutes a simple throttling control in which the liquid level would have to deviate below its control point (droop) to give full valve travel on large load changes.

To hold the level constant (eliminate droop) it is necessary to further increase the pressure on the control valve a small amount. The automatic reset bellows *B* does this job through the needle-valve connection between its liquid-filled bellows and that in *A*. Both of the small inner bellows,

being spring-loaded and connected through a common push rod, will return to their normal position when the liquid pressure in left-hand unit equalizes with that in right-hand unit through adjustable needle valve.

As the pressures equalize, push rod moves to left and the flapper begins to cover its nozzle and increase the air pressure enough to bring the level back to its control point. Moving fulcrum *X* vertically adjusts the throttling range, and position of needle valve determines return rate to control point.

CIRCULAR BAFFLE UNIT

The pneumatic controller, Fig. 20, employs a circular baffle to throttle nozzle discharge. Complete instrument includes preact and automatic reset devices. To follow its operation assume that liquid level is starting to deviate downward from its control point.

Primary-element arm *A* rotates clockwise and moves hook arm *B* counterclockwise about its pivot *C*, to lower circular baffle extension *D* and cut off air discharge from nozzle *E*. Therefore pressure builds up in capsular chamber *F* and raises ball valve *G* against its upper seat to shut off air pressure to valve's diaphragm chamber *H*.

When liquid level reaches the control point, left end of arm *B* lifts circular baffle *D*, which pivots at *I*, away from nozzle *E*. Air escapes and deflates capsular chamber *F*, which lowers ball valve *G* to some position between its upper and lower seats. (Passage *J* acts as a bleed vent to adjust or relieve pressure on diaphragm-valve line.) Air flow then partially closes diaphragm valve to maintain the level at the desired point. If liquid level exceeds its control point, arm *B* moves baffle still farther away from orifice. Capsular chamber then deflates, lowering the ball to its lower seat, shutting off exhaust passage J. Full air pressure then acts on valve diaphragm.

So far we have discussed only the simple operations of the controller without considering the various corrective elements. Assume the controller is at equilibrium and we wish to lower the control point. Turning knob *K* clockwise rotates gear wheel *L* to lift baffle pivot point *I* and raise baffle away from nozzle. Resultant decreased pressure in capsular chamber lowers ball towards its bottom seat, which allows more pressure to act on valve diaphragm.

This pressure also acts on the outside of bellows *M*, pushing it to the left. A pin transmits this movement to parallelogram *N*, which swings nozzle upward around its pivot *O*, to follow circular baffle until air pressure is properly regulated. Turning the hand knob *P*, adjusts for correct output pressure and restores the control point to the set point.

This restoration is performed automatically by inner bellows *Q* and needle valve *R*. Any new pressure applied to diaphragm valve is also applied to needle valve *R* and outside of bellows *M*, through needle valve *S*, causing nozzle *E* to move upward until circular baffle again throttles the escaping air. Differential pressure leaks through needle valve *R* to inside of bellows *M* and moves it to the right. Thus the nozzle is moved away from its baffle, which results in a further increase in the output pressure from the capsular valve to maintain the same differential pressure across the needle valve.

The increasing output pressure slowly closes diaphragm valve and the decreasing flow lowers the level toward the set point. Air flow through needle valve to the inside of bellows *M* decreases with decreasing pressure differential, which is proportional to the pen distance from set point. When pen reaches the set point, nozzle is at equilibrium position, equal pressure is acting both outside and inside of bellows *M* and reset response ceases to act since no differential pressure exists across needle valve *R*.

PREACT DEVICE

An adjustable sensitivity controller produces an output pressure change proportional to the amount of pen deviation. Preact device *S*, interposed between the capsular valve and follow-up bellows *M*, adds a response proportional to the rate of pen deviation by retarding air flow to and from bellows-operated sensitivity-adjusting assembly.

Suppose that the control is at equilibrium with an output pressure of 6 psi on diaphragm valve and on outside of bellows *M*, that controller is set for a sensitivity of 4 psi per inch of pen travel, and that preact setting is one minute. If the level begins to increase at a constant rate of 1-in. pen travel per min. without preact, output pressure would rise at the rate of 4 psi per min; or one minute later it would be 10 psi. However, needle valve *S* retards air flow to bellows *M* so that nozzzle does not follow rising baffle so closely.

Pressure rise in capsular chamber also lags, ball valve remains lower and its output pressure stays higher than dictated by proportional response alone. Therefore valve-closing action is accelerated. With an additional output pressure change of 4 psi from the preact, total output pressure is 14 instead of 10 psi. Since this response is proportional to pen velocity, it gradually diminishes to zero when pen is stationary.

Although we described the operation of individual parts of this controller separately, they operate in unison on a change in liquid level. Starting at equilibrium, pressure from capsular valve is equalized on both sides of bellows *M* and valve diaphragm. If circular baffle moves in relation to its nozzle, capsular valve changes the air pressure on valve diaphragm and the entrance to needle valves *R* and *S*. Rate at which air pressure changes on both the inside and outside of bellows *M* depends on the adjustment of each needle valve.

COMBINATION CONTROLLER

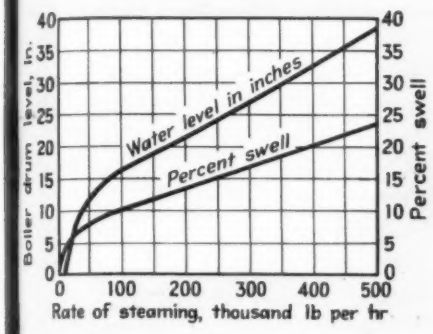
The pneumatic device, Fig. 19, forms one part of a combination electric-pneumatic controller. Electrical circuit is shown in Fig. 9 on page 79.

Turning as a unit with the measuring slidewire of an electrical-balance detector, a cam acts through levers to move the primary pilot-valve stem. Pilot valve outlet pressure corresponds to actual liquid level. Complete control includes a pneumatic balance that corrects automatically for droop. Bellows *A* is loaded by primary pilot-valve outlet pressure which, when level is at the control point, is one-half the supply pressure. Bellows *D*, while having only one half the lever arm of *A*, receives full-supply loading pressure.

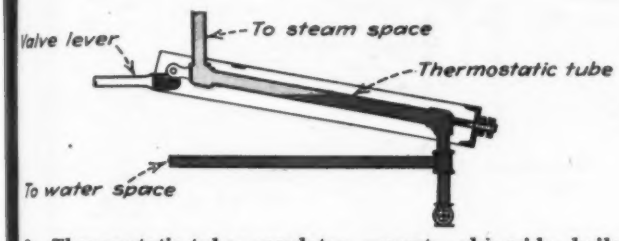
Bellows *B* and *C* have equal lever arms and each receives loading pressure from the secondary pilot valve when the balance is in equilibrium. Any change in primary-pilot-valve outlet pressure acts on bellows *A* to move the balance arm and cause a like change in secondary-pilot-valve outlet pressure. This changed secondary pressure acts on the valve diaphragm and also on bellows *B* to offset the pressure change in *A* and bring the balance back to equilibrium momentarily.

Pressures in *B* and *C* tend to equalize at once through needle valve *E*. This causes bellows *C* to move the balance arm and valve stem still farther in the same direction. Thus a further change in secondary-pilot-valve outlet pressure goes both to the valve diaphragm and bellows *B*. The balance thus assumes equilibrium at a new arm position, with pressures in *B* and *C* equal and that in *A* again one half the pressure in *D*. Secondary pilot valve holds a new position corresponding to the new load and liquid level is again at the control point.

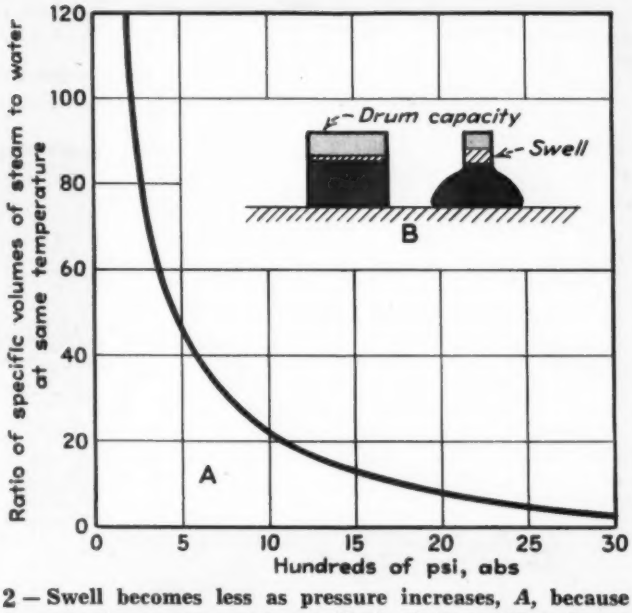
Feedwater Control



1 — Swell effects in a cross-drum waterwall boiler containing about 86,000 lb of water



3 — Thermostatic-tube regulator mounts alongside boiler so that water level cuts across tube near its axial center



2 — Swell becomes less as pressure increases, *A*, because steam and water approach equality in their specific volumes

Automatic feedwater control, a specific and familiar application of liquid-level control, promotes safety and increases steam-generating efficiency. To better understand its value, let's first see how water acts inside boilers.

A modern steam generator, whose heating surface consists largely of waterwalls, economizers, superheaters and reheaters, has less than one half as much water storage in the drum as the average boiler of 15 years ago. Today's unit can evaporate water stored in the drum in a few minutes if feedwater supply stops during heavy loads.

When a boiler produces steam, the circulating water's density is reduced both by its heat and the vapor bubbles entrained in it. Therefore, as steaming rate rises a fixed weight of water has increasing volume, or *swell*. During high steaming rates a large percentage of boiler volume below the water line is occupied by steam bubbles; a 26,000-sq-ft crossdrum boiler with waterwalls showed 24% swell when delivering 500,000 lb per hr, Fig. 1.

Swell is more important at relatively low pressures than at higher because one pound of low-pressure steam occupies a much greater volume than one pound of water at the same temperature, Fig. 2*A*. A boiler that has large heat-absorption area in tubes and waterwalls, with small drum storage, is more affected by swell than a firetube unit, Fig. 2*B*.

This inherent characteristic (swell and shrink) materially assists in maintaining constant boiler pressure. On sudden load increase, water level rises and feedwater regulator temporarily reduces the lower-temperature feed supply; this helps increase evaporation. On sudden load decrease, water level falls and regulator increases the feed; this helps lower the boiler pressure. Temperature of feedwater in comparison to that in the boiler and the rate at which water enters the boiler reduces swell to a greater or less degree.

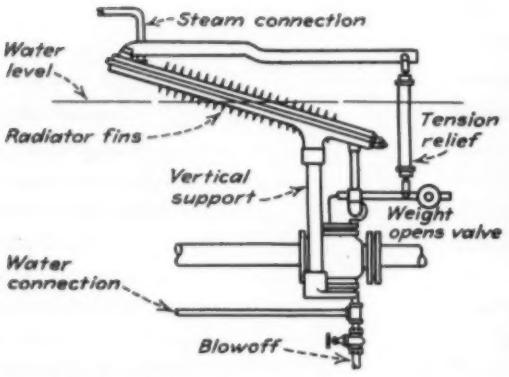
COUNTERACTING SWELL

Although effects of swell cannot be eliminated entirely, best results sometimes call for regulation with a *rising characteristic*, (rising level with increasing load). Carrying low water at light loads avoids danger of carryover from swell during sudden load increases. Conversely, it may be desirable to carry high water on heavy loads to avoid exposing tube area from water shrink during a sharp load drop.

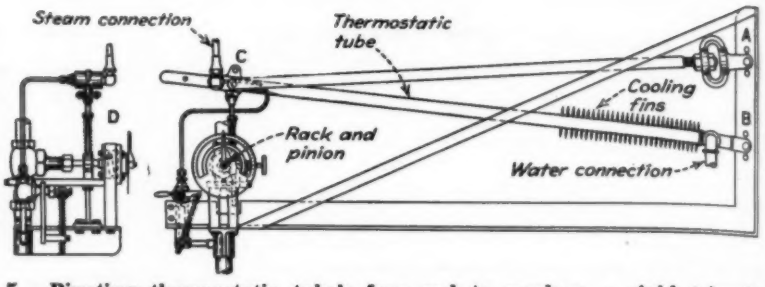
So much for water-level action in the boiler. And now, how can the water level be controlled? Simple, rugged, reliable feedwater regulators are capable of adjusting the feed with minimum time lag. Many of the previously described primary elements serve admirably for this purpose. Additional ones include (1) thermostatic tube (2) steam generator and (3) varying-pressure chamber. Control can be one-element — in which the feed valve is controlled by water level only; 2-element — with both water level and steam flow acting to control the feed valve; or 3-element — in which steam flow, feedwater flow and water level act to control the feed valve.

Thermostatic-inclined tubes, Fig. 3, 4 and 5, usually of brass or other alloy, with a high coefficient of expansion, mount alongside the boiler so that the water level cuts across the tube near the center of its working length. Tube's lower end is anchored and connects by piping to the boiler below its water level; upper end is free to move and connects through a long-radius pipe bend to the boiler steam space. An insulated steam lead properly sloped towards the boiler minimizes condensate flow into tube.

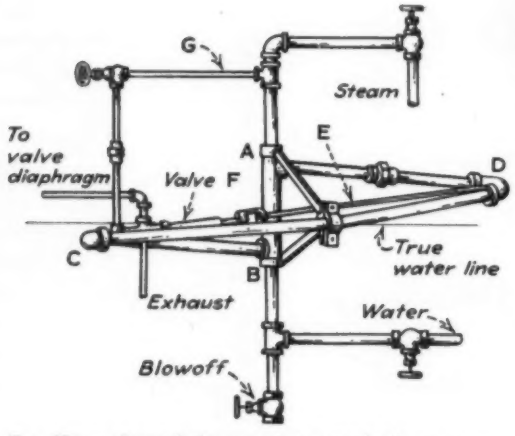
When the boiler water level changes, the tube water level moves the same vertical distance; but length-



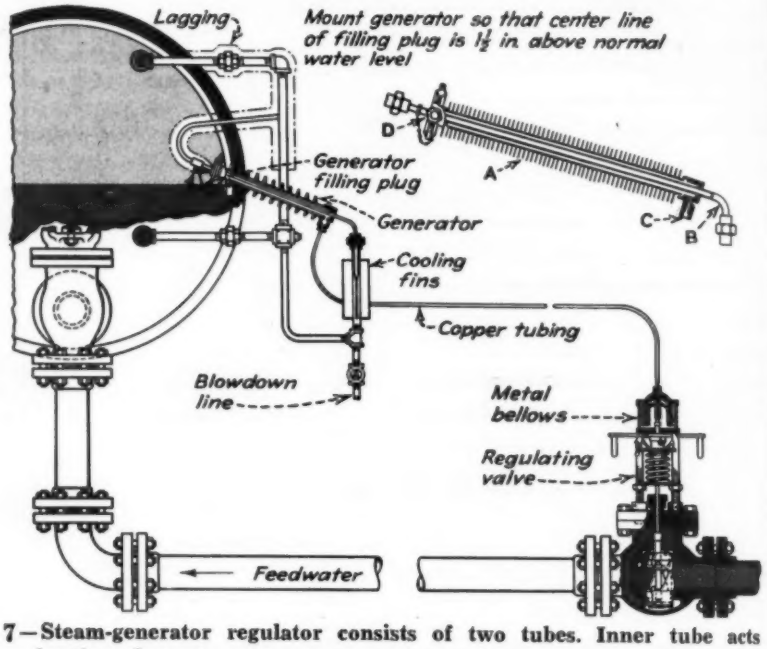
4 — Radiating fins attached to the water end of the thermostatic tube accelerate cooling



5 — Pivoting thermostatic tube's free end to produce a rigid triangle multiplies tube's expansion. The movement operates a screw-stem valve



6 — Harp-shaped thermostat uses boiler pressure to operate diaphragm-motor feed valve



7 — Steam-generator regulator consists of two tubes. Inner tube acts as heating element; outer one generates pressure to operate feed valve

wise change in the tube level depends on tube slope. This water does not circulate; therefore, it cools off by radiating heat to the atmosphere. Some tubes, Fig. 4 and 5, carry radiating fins on their water end to accelerate cooling. Since the tube's steam end is always hot, any change in water level either reduces or increases the surface contacted by hot steam, thereby contracting or expanding the tube. To complete the regulator the tube's free end connects through suitable linkage to a relay, or regulating valve, in the feedwater line.

The design in Fig. 5 multiplies expansion by pivoting the tube's lower end to a vertical frame member, which carries a pivoted rigid bar that connects to the tube's free end. Pivoting points *A* and *B* are 7 in. apart, and produce a rigid triangle. As the ratio of the length of the long sides to the short is 6 to 1, a change in tube length raises or lowers the tube end *C* approximately six times the amount of that change. Free end of tube connects to the control valve's rotating stem through rack and pinion *D*. A small pipe between feedwater line and steam end of tube permits filling it with relatively cool feedwater after blowing down.

The harp design, Fig. 6, utilizes boiler pressure to operate a diaphragm-motor feed valve. Top and bottom of column *AB* are connected by harp-shaped copper tubes with their extreme ends *C* and *D* in a straight line. Expansion and contraction concentrate at the tube ends and act on rod *E* and valve stem. Valve *F* regulates steam flow from pipe *G* to regulating-valve diaphragm.

TUBE OPERATION

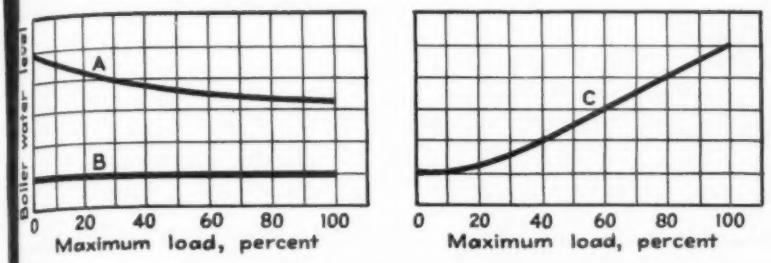
Inconsistencies in thermostatic-tube operation result from two causes: (1) Hot condensate from the steam connection runs down and warms the tube's lower end. (2) The water connection, after being blown down, is refilled with hot boiler water. With all of the cool-water reserve blown out, hot water equalizing back from the boiler expands the tube and momentarily opens the feedwater valve.

Steam-generator regulator, Fig. 7, consists essentially of two tubes, an outer one, *A* (insert), fitted with cooling fins, and an inner one, *B*, which serves as a heating element, connecting to the boiler drum above and below the water level. Inner tube then contains steam and water, the water level being the same as that in the boiler drum. Annular space between inner and outer tubes forms a closed system with the connecting copper tubing and metal bellows of the regulating valve.

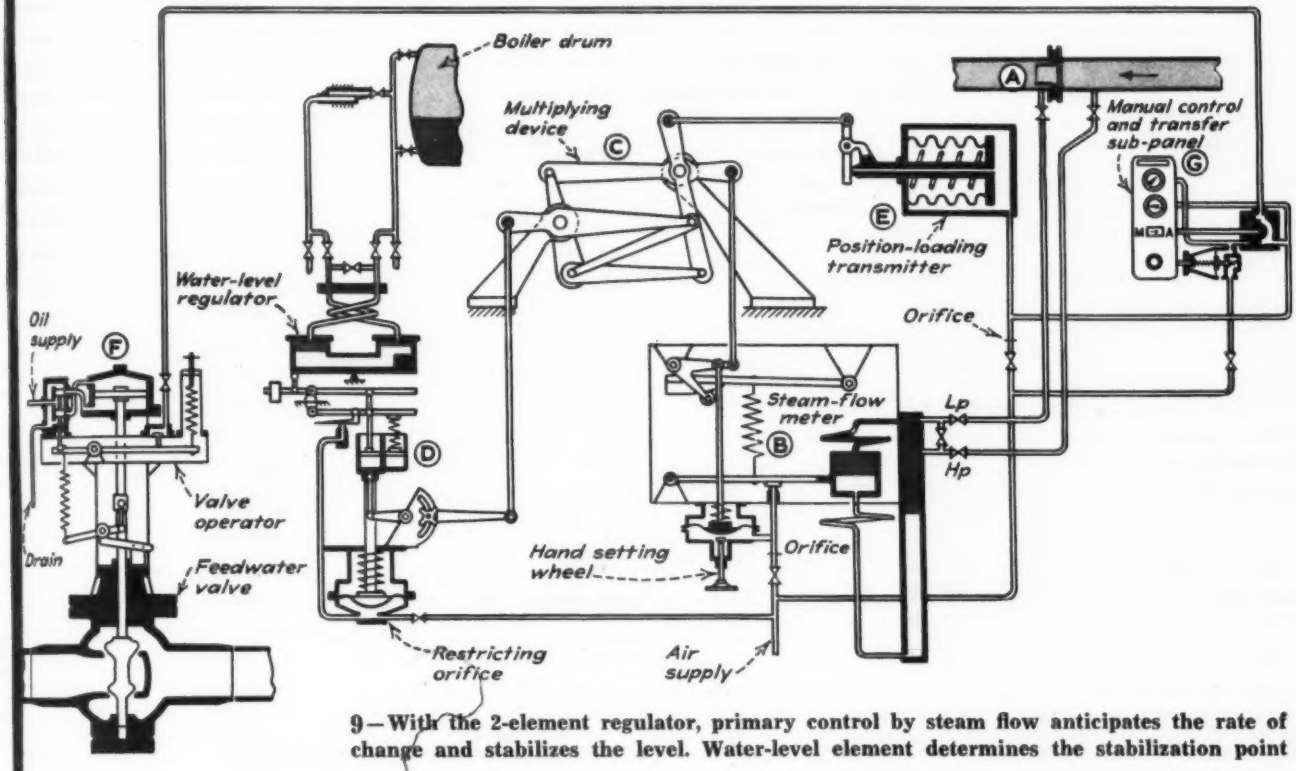
Volumes in the closed system are so proportioned that when steam completely fills the annular space the regulating valve is wide open, but when water fills this space valve is closed.

The generator shell has two openings, one at the bottom *C* that connects to copper tube leading to the regulating valve, and the other at the top *D* for filling the system with water. This opening is placed on the side of expansion head to prevent overfilling the generator.

Water leg from the boiler carries cooling fins to insure a supply of rel-



8—Liquid level regulators are available that: *A*, allow level to fall as load increases, with accurate control of level from minimum to maximum load. *B*, maintain constant level at all loads except for swell and shrinkage. *C*, raise water level as load increases, with accurate control at all loads from minimum to maximum



9—With the 2-element regulator, primary control by steam flow anticipates the rate of change and stabilizes the level. Water-level element determines the stabilization point

atively cool water at the bottom of inner generator tube. When boiler-water level rises, this cool water passes up into the tube and helps condense steam in annular space of outer tube.

Varying-pressure-chamber unit, Fig. 10, operates on the theory that when dry steam flows through chamber *F*, having an inlet orifice smaller than the outlet, pressure in *F* is in proportion to that in *J* as the areas of the two orifices are in proportion to each other. If, however, the steam contains moisture that immediately flashes to steam, pressure in *F* increases in proportion to the moisture content until hot water enters.

When a properly designed open-end pipe extends from chamber *F* down into the water column, dry steam enters the pipe when water level is low, whereas water enters when level is high. Pressure inside the pipe is lower than that in the water column because of constant discharge through *D;* consequently water level is higher inside the pipe than it is outside. Holes drilled through the pipe permit steam to mix with the water inside. This gives a gradual increase in the steam's moisture content until the rising-water level covers all the holes. When the boiler level is low all the holes in pipe *J* are exposed. Then, only dry steam passes to chamber *F*, and since pressure is not sufficient to close the diaphragm-operated valve connected to line *G*, feedwater flows to the boiler.

INCREASING LEVEL

As the water level increases, it rises in sampling pipe *J*, mingles with the steam entering through the upper holes, and a mixture of steam and water passes into chamber *F*. Part of the water flashes to steam and volume of the mixture increases. Frictional resistance of orifice *E* to its outflow also increases, building up pressure in chamber *F* until it positions the control valve properly.

One-element regulators (those operated only by the boiler-water level) provide continuous feed in proportion to steam output, and hold the level steady so long as one constant load prevails. But because they change the feed-valve position only with a change in drum level, valve opening increases only when water level falls. This produces a falling characteristic *A*, Fig. 8, carrying a lower level with each load increase. The original and simplest one-element regulator is a float operating in a chamber connected with the boiler drum. Any complete one-element system, Fig. 7, is entirely satisfactory for many applications because it offers low first cost and greatest simplicity. But for applications requiring other than a falling characteristic, regulation must be under the control of more than one element.

With the steam-flow, or 2-element, regulator, Fig. 9, primary control by steam flow from the boiler anticipates the rate of change and stabilizes the level instantly. Water-level element determines at what drum level stabilization occurs. Feedwater valve is controlled jointly by both the water-level and steam-flow elements. Steam-flow unit may be actuated by pressure drop through the superheater or

an orifice placed in the main steam line. Increased steam flow creates greater pressure drop through the orifice, or superheater, which causes the feed valve to open a definite distance. Because the steam-flow element can be adjusted for any predominance, it is capable of maintaining a constant level regardless of load, or of giving a rising characteristic, *B* and *C*, Fig. 9.

In Fig. 9, changes in flow through steam nozzle *A* change differential pressure on mercury manometer in *B* to move air-orifice throttling arm and position the diaphragm rod connected to multiplying device *C*. Level controller *D* positions its connecting rod to multiplying device *C* and the joint control acts on nozzle-throttling device *E* to regulate the air pressure on reaction diaphragm of regulating-valve positioner *F*. Change from automatic to manual control or vice versa is made by first adjusting *M-A* regulating valve on control panel *G*.

Multiplying device *C* can be adjusted to limit maximum water feed to the boiler when non-return valve closes. Thus it controls the amount of water diverted from other boilers if a tube ruptures.

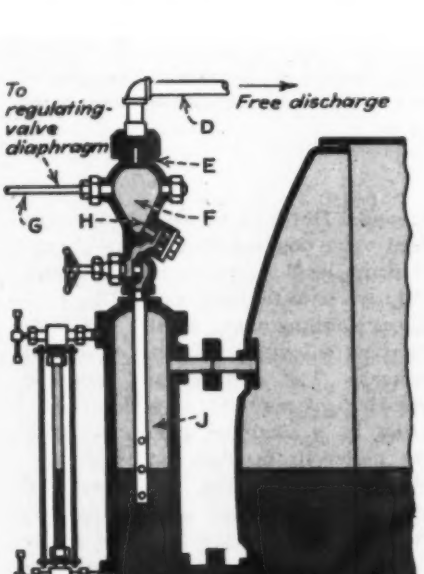
The balanced flow, or 3-element, regulator, Fig. 11, is a 2-element unit to which has been added a third element—one responsive to rate of feedwater flow. Water-flow element is similar to the steam-flow, but is actuated by pressure drop through feedwater heater or an orifice in the feed line.

Manometers *A* and *B* accurately measure steam output and water flow respectively and balance these measurements through the ratio beam that operates an air pilot valve. Control functions primarily from steam flow, modified slightly by water level when necessary to hold the level within desired limits. When water input falls below or rises above steam output, pilot valve *C* varies the air loading pressure beneath relay upper diaphragm. As a final check, pilot valve *D* actuated by water level varies the air pressure above relay upper diaphragm. Resultant of these two pressures moves relay stem to operate valves in relay lower chamber that modify loading pressure to feedwater regulating valve. Setting the link *E* at the midpoint of ratio beam maintains a constant water level. Moving it to the left gives a rising characteristic with increasing load.

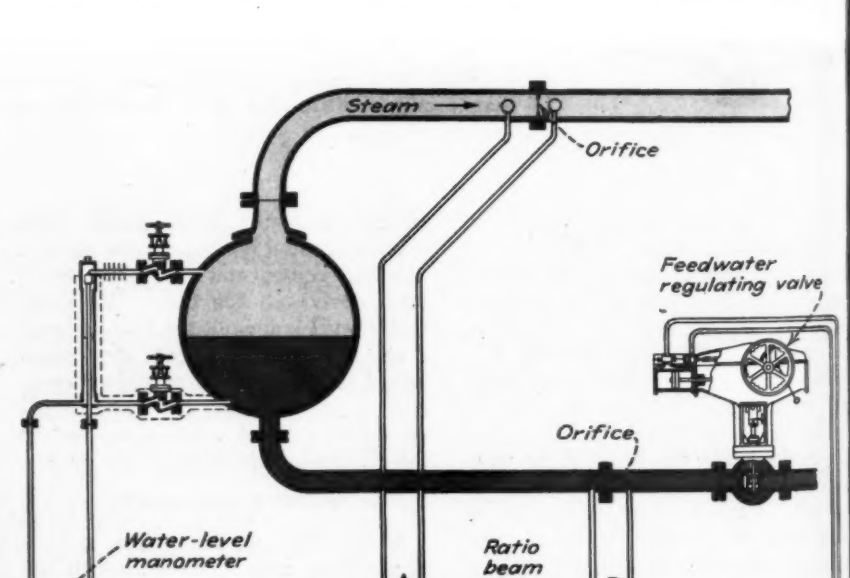
Feedwater control systems that incorporate a relay between the regulator and control valve relieve the regulator of moving the heavy valve and permit it to operate more sensitively and accurately. In general, relay operation is recommended when: (1) boiler pressure exceeds 600 psi (2) a 5-in. or larger feed valve operates with a normal pressure drop across it exceeding 75 psi or (3) normal flow through the control valve exceeds 400,000 lb per hr. It is also recommended for any 2-element regulator when pressure drop through the superheater at maximum load exceeds 50 psi, and for any 3-element regulator.

ACKNOWLEDGMENTS — III

For material used in preparing this section POWER is indebted to Alco Valve Co, Askania Regulator Co, Atlas Valve Co, Automatic Temperature Control Co, J A Campbell Co, A W Cash Co, Fisher Governor Co, Golden-Anderson Valve Specialty Co, Griscom-Russell Co, Hagan Corp, Hays Corp, Henszey Co, Kieley & Mueller Inc, Klipfel Mfg Co, Northern Equipment Co, R-S Products Corp, Sarco Co, C E Squires Co, Stets Co, Strong Carlisle & Hammond Co, Swartwout Co, Watts Regulator Co. See additional listings on pages 67 and 72.



10—Quality of the mixture entering chamber *F* determines pressure at *G*



11—This 3-element regulator measures drop across orifices in steam and water lines. Each element operates a pilot valve in the air supply to the controller

TWIST THE DIAL for 1500-PSI STEAM

Forced-circulation cellular packaged boiler unit supplies superheated or saturated steam at any temperature and pressure, or even hot water, under instant automatic control for test, standby or what-have-you

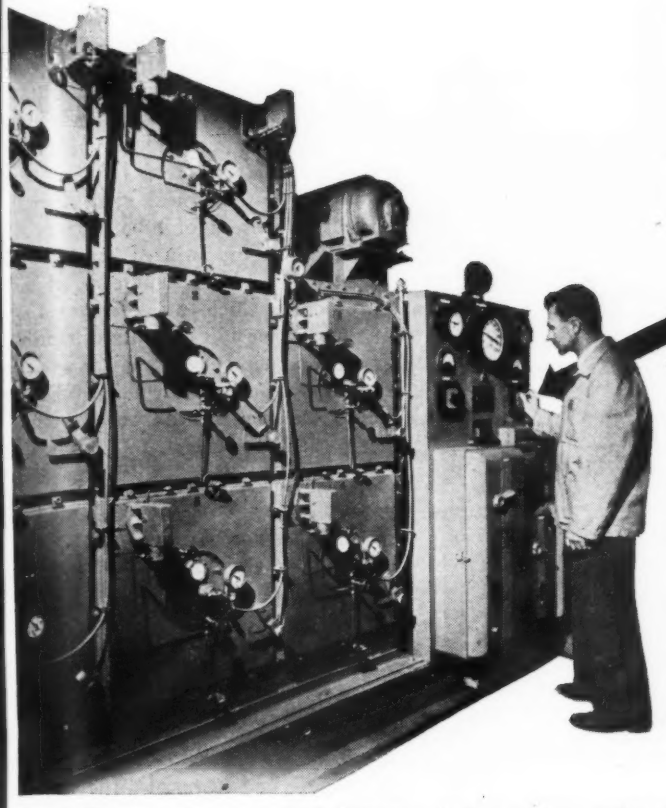


Fig. 1—Closeup of six saturated-steam and two superheat sections. Firing rate, feedwater and air supply are controlled individually for each boiler section

▶PRODUCING saturated steam, superheated steam or high-pressure water under accurate control, individual-cell forced-circulation boiler units have been widely used for steam and hydraulic test work on valves, packing, piping, engines, turbines (POWER, Feb, 1945, p. 67) insulation and similar items. Contribution to the shipbuilding program has included "portable" units swung aboard ships, which have materially improved former test procedures for checking piping and turbines in place.

Steam-boiler designs developed by Besler Corp of Emeryville, Calif., have the structural appearance of a giant drawer file. Separately fired forced-circulation sections are basically each a single, long tube wound into helical coils to form a combustion chamber and spiral coils, Fig. 4, for convection surfaces at each end of the helical firebox coil. Each section has its own burner, over-temperature control and built-in soot blower. The entire tube assembly for each section slides into position, Fig. 3, on the structural-steel assembly frame. It is readily removable for inspection, repair or replacement.

Early boilers of this design operate on a "normalizer" cycle in which saturated steam is superheated in the same boiler section, outlet temperature being controlled by injection of a proportioned amount of feedwater into the superheater near the outlet. While this cycle offers a wide range of temperature and pressure, particularly useful in test boilers, the carryover of dissolved solids into the superheat section makes early tube failure a possibility in continuous operation if bad feedwater must be used.

A later development is the "spill-over" cycle with separately fired superheater. More feedwater is fed to the saturated-steam section than is needed. Excess water is removed by a highly

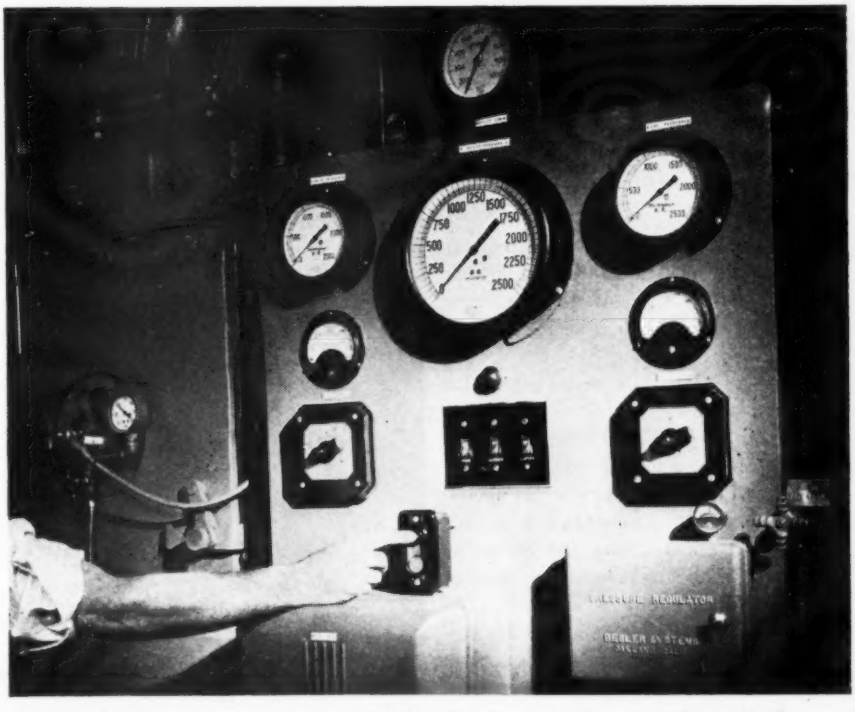


Fig. 2—Closing main and burner switches brings unit up to predetermined steam conditions in two minutes; boiler automatically responds to load fluctuations

Fig. 3—Complete tube assembly for one section slides in place. Front plate, carrying oil or gas burner and over-temperature control, bolts on steel frame

Fig. 4—Spiral-coil assembly, carrying built-in soot blower, is fitted to helical-coil unit to complete saturated-steam-producing section of test boiler

efficient (99.2%) cyclone separator before steam passes to the superheat section. Firing rate of the separate superheater controls final steam temperature.

Boilers of this type were originally developed to meet widely varying requirements in output, temperature and pressure required for specific test applications, and certain other special needs, without the high cost entailed in designing and constructing special units for each. In this sectionalized design, relatively large numbers of mass-produced standard boiler sections are assembled in the proper number and arrangement to produce any capacity or steam conditions required.

In addition to lower manufacturing costs, sectionalized designs have other advantages. Separately fired sections can be cut out or refired at will to give a range of outputs much wider than conventional designs. Efficiency is high at low loads because only enough individual sections are fired to carry the load at somewhere near their normal capacity. In event of tube damage or other failure, the injured section can be cut out without shutdown of the entire boiler, which can be operated indefinitely at the full capacity of remaining sections without further damage. If necessary, a new factory-made tube assembly can replace the failed section in less than four hours.

No Heat Storage

Continuous-flow arrangement of the boiler tubing, eliminating all drums and headers, minimizes stored-water capacity and permits almost instantaneous steam-up and shutdown without damage or excessive heat losses. Coiled-tube firebox without refractory assures minimum contained heat on shutdown.

Lack of any appreciable amount of stored water and steam also reduces explosion hazard to negligible proportions. The "low-water" condition met with conventional boilers when steam demand increases suddenly is meaningless with the forced-circulation unit, which meters feedwater in direct proportion to firing rate of each section. With no drums or headers to interfere,

inhibited-acid cleaning affords rapid descaling without danger of settlement. Absence of drums and headers also obviates collection of sludge, sediment or mud and consequent necessity for flushing out the unit at frequent intervals.

Firing from cold involves first starting auxiliaries and then closing main and burner switches that control ignition and fuel. The unit automatically comes up to predetermined steam conditions and maintains them under full automatic control. Steam-up time from a stone-cold start is less than two minutes for test-boiler types, and less than ten minutes for high-capacity marine and industrial-power units.

Once on the line, the boiler responds automatically to load fluctuations maintaining desired pressure within close limits regardless of changing load. Superheater sections, almost automatically controlled, maintain a preset temperature independent of steam flow. Interconnected controls regulate firing rate of each boiler section and meter feedwater to it in direct proportion to its firing rate. Combustion air is similarly regulated by the interconnected control system which is actuated by pressure fluctuations in the main steam line. Each section has an over-temperature control which automatically cuts off the burner if temperature exceeds safe limits. A complete description of these standard controls appeared in an article "Shop Tests Okay Cargo-Ship Turbines" by F W Peterson of Joshua Hendy Iron Works, POWER, Feb. 1945.

Although actual proportions differ for each specific boiler, cubic measurements average one third to one fourth

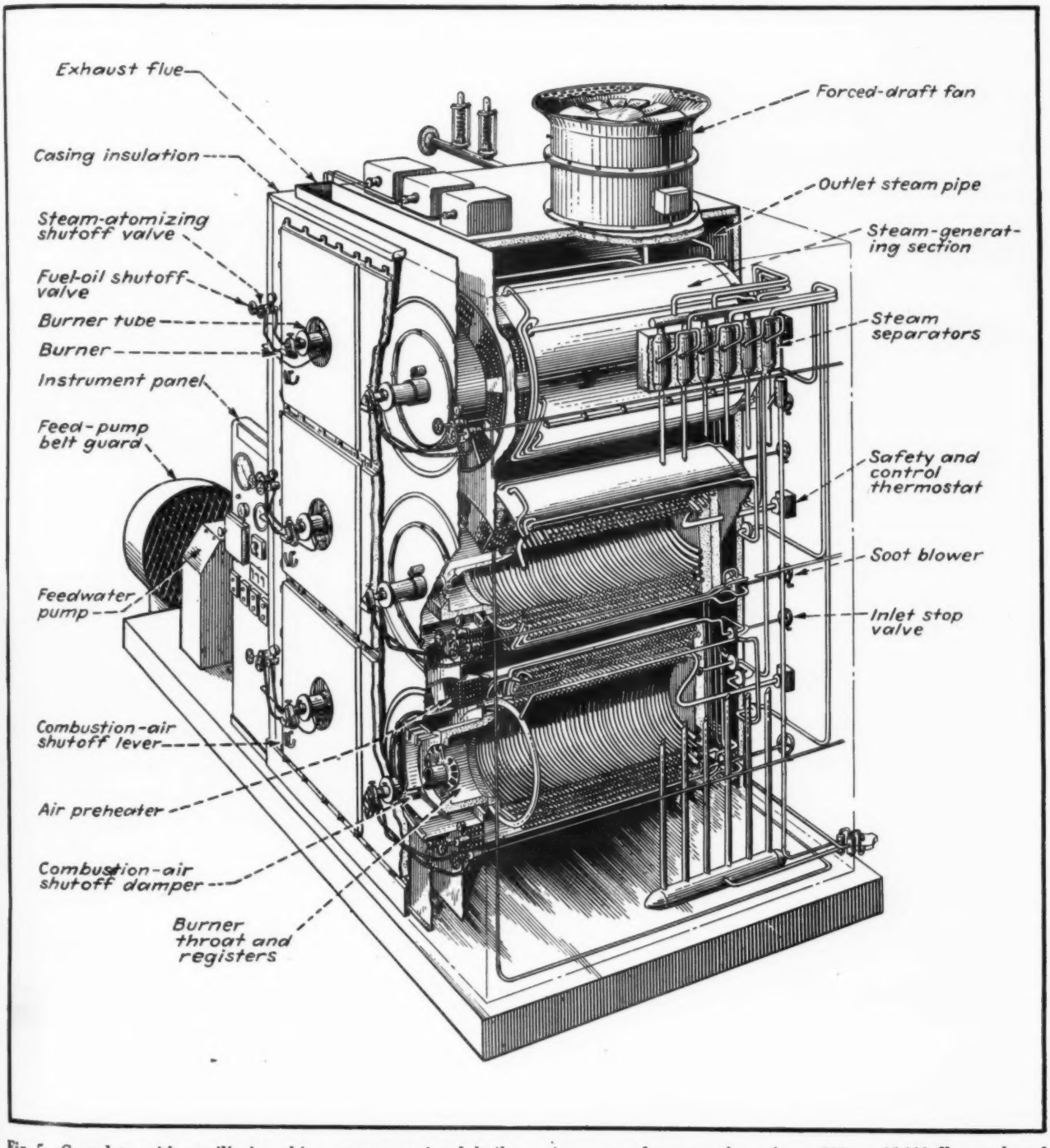


Fig. 5—Complete with auxiliaries, this compact sectional boiler unit can produce anywhere from 500 to 15,000 lb per hr of steam at any pressure up to 1500 psi and temperature to 900 F under automatic control and on a few minutes notice

those of conventional steam-generating units and total weight is about half that of the usual boiler of equal capacity. Specific comparison between a 30,000-lb-per-hr 900-psi 750-F unit and a conventional single-pass boiler are as follows:

	Besler	*Conventional*
Length	7 ft, 9 in.	20 ft
Width	9 " 0 "	13 "
Height	12 " 8 "	14½ "
Volume	890 cu ft	3770 cu ft
Weight	30,000 lb	120,000 lb

(Exclusive of foundations)

Factory Built

Complete factory assembly of the boiler, with all auxiliaries and control in place, is inherent in the design. Compactness and lightweight permit shipping the assembled unit by rail or truck, Fig. 6. Special foundations are usually unnecessary as weight seldom exceeds 175 lb per sq ft. No brickwork is required and a simple vent to atmosphere suffices for a stack.

Primary application for unit-section forced-circulation boilers has been for test installations, for which the unit is particularly well adapted. Several such boilers, of capacity ranging from 500 to 15,000 lb per hr at pressures up to 1500 psi and temperatures to 900 F, have served such turbine and engine manufacturing plants as De Laval, General Electric, Joshua Hendy, Murray Iron Works and Westinghouse. Others serve similarly in ship repair and Navy yards all over the world for testing valves, fittings and piping on repaired ships.

For the future, several different applications are now under consideration. Two types of marine-propulsion boilers are being completed for early installation. A larger industrial-power boiler using multiples of 5000-lb-per-section is undergoing final tests at present.

Wherever space or weight limitations are important factors, sectional forced-circulation boilers offer interesting possibilities. Rapid steam-up and instantaneous shutdown with negligible standby losses indicate a new approach to power-generation and process heat supply when operations are intermittent or cyclic. It is practical and desirable to shut down forced-circulation boilers nights and weekends for a plant operating on a single-shift 5-day-week schedule. Similar advantages obtain for intermittent or batch processing when continuous production is impracticable or impossible.

For direct power generation the 2-minute steam-up offers a practical answer to the problem of providing standby facilities at central stations and in industrial plants. Automatically controlled units can pick up overloads, or come on the line from cold in event of failure of other equipment, and shut down when demand drops.

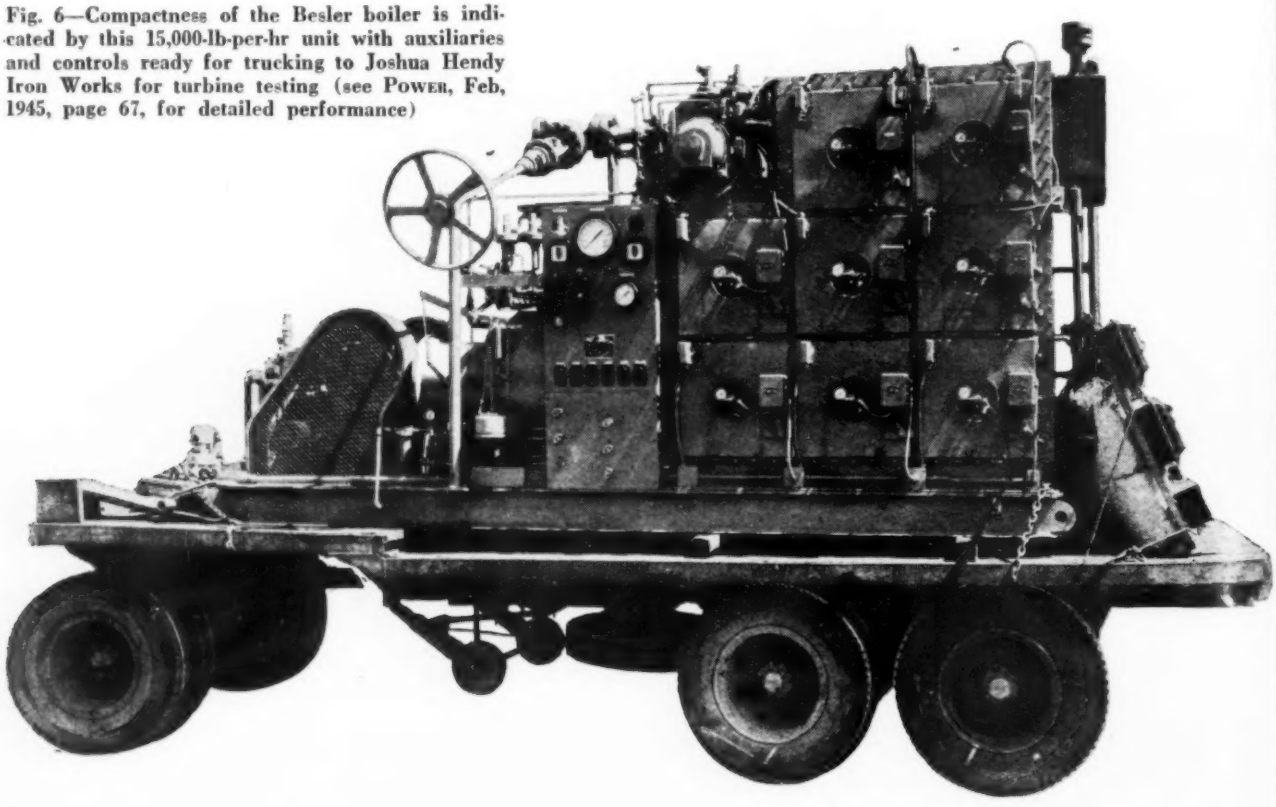
In the marine field, savings in boiler-room space and in "dead weight" possible with forced-circulation boilers offer obvious increases in cargo or passenger capacity. In size, weight, installation and operating costs, the forced-circulation-boiler power plant compares favorably with heavy-duty diesel engines. In addition, its sectionalized design makes possible "continuous" maintenance at sea, even to tube replacement, without shutdown.

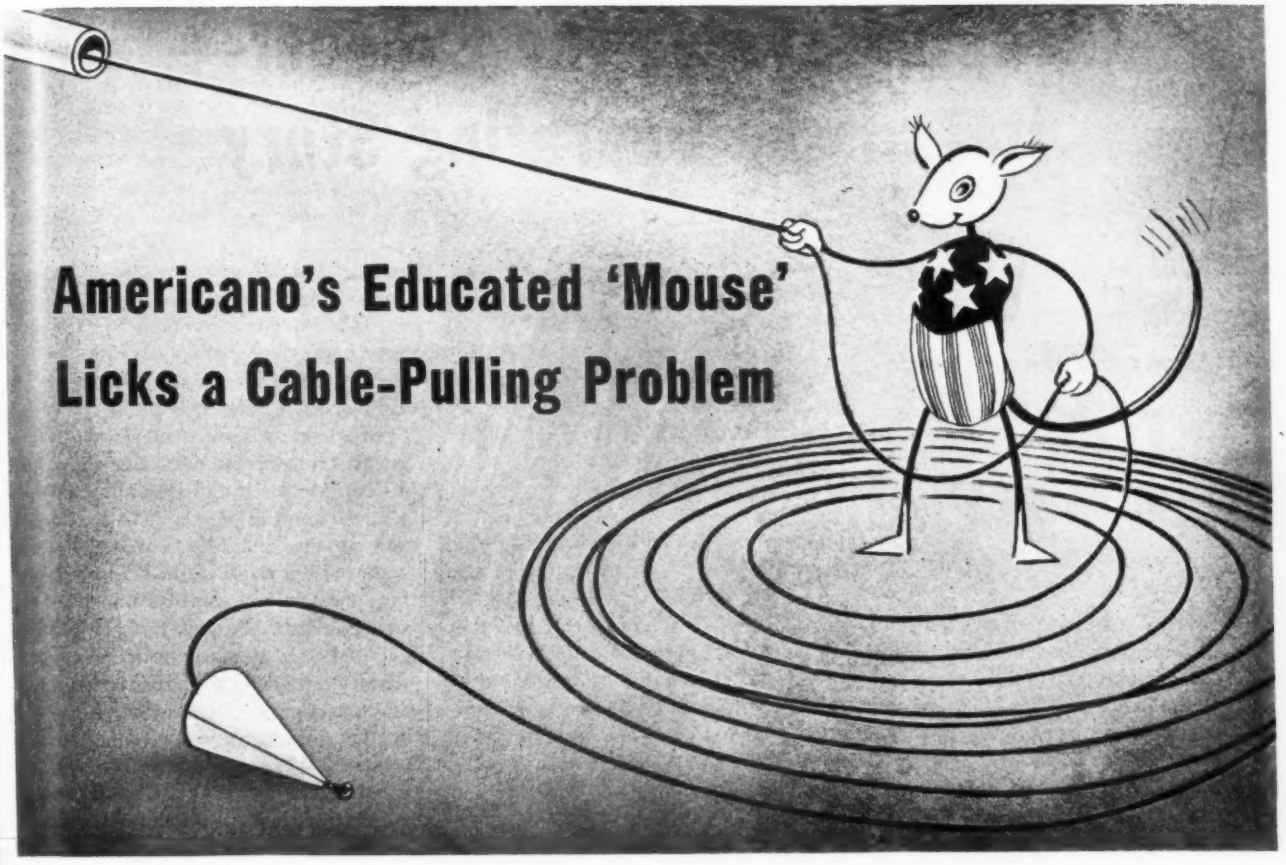
Smaller Units

Design and layout studies for replacement of existing heavy-duty diesels with forced-circulation boilers and high-pressure steam engines in the Army's 180-ft FP boats indicate an increase of 25% in cubic cargo capacity. In general, the complete power plant requires about half the space, weighs half as much and is lower in cost per hp than slow-speed heavy-duty marine diesels. Now being completed for test installation is a 200-shp marine steam power plant consisting of boiler with feedwater pump and all auxiliaries, a reversing engine, electric generator for ship lights, and condensers. The entire single inclosed unit is a 5x5x5-ft cube.

Flexibility, afforded by sectionalized construction, completely automatic operation and compact size of total plant, offers designers new possibilities in application of forced-circulation boilers.

Fig. 6—Compactness of the Besler boiler is indicated by this 15,000-lb-per-hr unit with auxiliaries and controls ready for trucking to Joshua Hendy Iron Works for turbine testing (see POWER, Feb, 1945, page 67, for detailed performance)





Americano's Educated 'Mouse' Licks a Cable-Pulling Problem

N L Rea, General Electric's erector extraordinary, tells how a 'mouse' in pinch-hitting for a 'fish' snaked cable through a conduit to the amazement of the assembled native citizenry

▶One of our erecting engineers, who was on a foreign assignment recently, reported that he was having trouble with a conduit system. It seems that conduit runs aplenty waited to be pulled but of fish tapes or cable grips there were none. In fact, the country in which he was so unhappily situated had never even heard of them.

The majority of foreign workmen and engineers, who have worked for years without fish tapes, cable grips and similar handy devices, remain convinced that there is only one way to insert cable into conduit. Their method involves first measuring and cutting the cable. Next they bend and fit the conduit, slide it piece by piece on the cable, make up the joints and carry the complete length of cable and conduit to its final location. Knowing this, I wrote to the erecting engineer as follows:

"Years ago, when fish wires were hard to get, some of the old timers developed a gadget to insert cable into conduit. They called it a "mouse." The device consisted of a cone made of thin leather, about four to six inches long, with the back edges scarfed from the inside. The mouth of the cone was made slightly larger than the conduit. A spool containing coarse thread or a light fish line was obtained and the end of the thread or fish line was fed through the inside of the cone, or mouse, out through the nose, and tied securely.

"The mouse was then inserted well into the conduit and the spool mounted so that it would run freely. The mouse, carrying the thread, was forced through the conduit by means of an air hose. However, if an air hose was not available, a hand bellows was often used successfully. Next the thread was tied to a larger cord and drawn through the conduit. This heavier cord was used to pull the wire or cable into the conduit. In the old days, when we did a great deal of switchboard installation, this was standard practice.

"If fish wire is forced through the conduit, it is very easy to make a soldered splice to the copper on the cable end and then protect the insulation with tape. This makes it simple to draw the cable into the conduit without first pulling a heavy cord through. This scheme was used frequently before cable grips were invented."

In answer to my letter, I received the following note from the erecting engineer:

"Your recent letter explaining the mouse was most welcome and it certainly arrived at just the right time. We were struggling to get spring wire through the conduits with absolutely no success. To say the mouse was phenomenal would be a gross understatement. After repairing the local air compressor, we pulled cable through all the conduit in two days.

"The use of the mouse caused as much of a sensation here as would Hitler pushing Stalin in a wheelbarrow down Main Street at home. People came from miles around to see the Americano's educated mouse perform."

Keep an Eye on the Exhaust—It Tells an Operating Story

Easily made part of day-by-day routine, checking exhaust temperature and condition reveals faulty combustion and mechanical defects on diesels and gas engines

► GOOD OPERATORS have always kept an eye on engine exhaust—literally, in the watch for smoke and other signs of faulty combustion and, figuratively, in the regular check of exhaust-pyrometer readings. Such observations are both easy to make and dependable, proving especially valuable for day-by-day routine.

Just about everything that happens inside the cylinders leaves its trace in the exhaust, changing its temperature, appearance and chemical analysis. Convenient temperature measurement proves so important to the operator that pyrometer equipment is virtually standard practice in a modern plant. As usually applied, the apparatus consists of thermocouple elements at or near the points where exhausts from individual cylinders enter the manifold; a single millivoltmeter to register the current flow from the elements and indicate it in terms of temperature, and a selector switch to connect the individual thermocouples to the millivoltmeter in any desired sequence.

The thermocouple element contains the familiar pair of dissimilar-metal wires welded together at one end. Fig. 1 shows how the basic thermocouple principle is worked out in practice for convenient and reliable use in an engine exhaust pipe. Extension wires connect the element wires to the millivoltmeter or its selector switch. The welded end forms the *hot junction*; the other end is the *cold* or *reference junction*. When extension wires are copper, the reference junction is at the connection point. Use of alloy-metal extension wires extends the dissimilar metals of the thermocouple back to the connection at the indicator or selector switch and this becomes the reference junction. Always use alloy extension wires with pyrometer indicators containing automatic cold-end compensators.

The thermocouple, when heated, generates a voltage proportional to the temperature difference between hot and cold junctions and thus the indicator scale can be calibrated directly in degrees Fahrenheit. Accurate reading depends on careful setting of the cold-end temperature, which should register on the millivoltmeter when it is not connected to any thermocouple. This is done by placing a dependable thermometer close to the cold-end terminals, whether at the couple or at the switch, shielding the bulb from drafts or direct radiation, and allowing temperature to stabilize.

Adjust Cold End

When thermometer temperature remains steady (This may take up to an hour.) adjust the indicator to show the cold-end temperature thus measured. If the indicator contains an automatic cold-end compensator, the pointer will shift to follow temporarily ambient-temperature changes.

Properly adjusted, the exhaust pyrometer permits quick and convenient reading of temperatures from individual cylinders. Logging these temperatures allows comparison from day to day. Using temperature changes to diagnose engine conditions depends on having some "good" set of readings at various loads to refer to for comparison. With a new engine, or newly installed pyrometer, the operator must start by establishing such reference points.

Frequent readings should be taken over a considerable period during which all engine operating factors are watched with extreme care. If at all possible, performance should be checked by indicator or any other available means. If operator has conscientiously made sure that load is evenly divided between cylinders and that engine is in topnotch shape mechanically, individual cylinder readings should be about the same and in the normal range for the engine.

Any marked departure from the exhaust temperatures established by experience as being right for the particular engine warns of potential trouble. For example, high readings on all cylinders usually mean overload. Lack of balance in loading between cylinders shows up as high exhaust temperature on some and low temperature on others. Inadequate jacket cooling caused by scale deposits also causes higher exhaust temperature, but the increase appears at all loads. This fact and general observation make it possible to tell easily whether high exhaust temperature results from a general overload condition or insufficient jacket cooling.

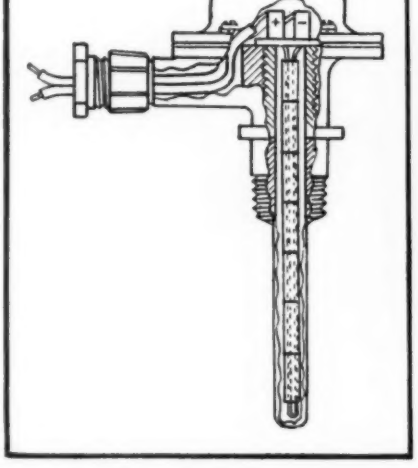


Fig. 1—Cutaway view showing construction of a typical thermocouple element

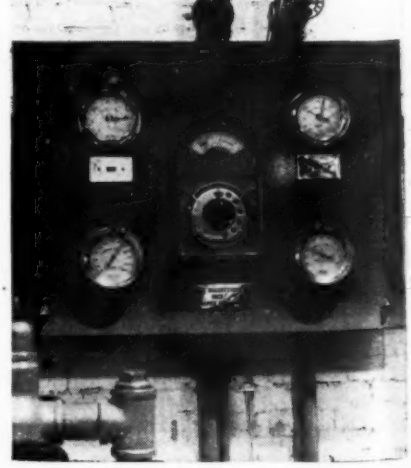


Fig. 2—Pyrometer indicator (millivoltmeter) and 6-cylinder selector switch

Changes in exhaust temperature also serve to indicate faulty combustion. On diesels, high temperature may mean delayed fuel injection, low injection-air pressure, or too little fuel-valve clearance. Low temperature points to the reverse of these conditions.

In common with most other devices for checking engine performance, the exhaust pyrometer warns that something is wrong and gives a general indication of the source of trouble. No instrument yet devised can put a finger on the one and only cause of poor operation if for no other reason than that many faulty conditions have their beginnings in a number of maladjustments. The important thing is to heed the warning promptly, find the cause of the difficulty and correct it before it becomes serious, causing a shutdown and costly repairs.

If the exhaust-pyrometer indications are to be dependable, the operator must keep the instrument in good condition. Check the thermocouple element regularly for cleanliness. The protecting tube which prevents burning, contamination and general deterioration of the thermocouple wires may become coated with carbon or soot from the exhaust gas. Such a deposit interferes with the accuracy of the temperature indication and makes the system slow to respond to quick changes in exhaust temperature. Removal of the element for cleaning may require disconnecting the extension wires; make sure polarity markings are correctly followed in reconnecting.

Faulty Readings

Loose connections in the extension wiring or at the selector switch also cause faulty readings. Inspect for looseness, corrosion or dirt regularly. Check extension wires for faulty insulation; if stranded, examine flexing points for broken strands likely to cause shorts. Extension wires should never be exposed to extreme heat or cold and, of course, should be kept away from water or oil.

Indicators are rugged instruments and if not subject to rough handling should give relatively long periods of trouble-free service. If the instrument is abused or subject to excessive vibration, or if inspection shows pivots and jewel bearings need cleaning, polishing or replacing, return the instrument to the manufacturer. Such operations require specialized skill and facilities not normally available in the engine plant.

Remember that the indicator, a millivoltmeter, responds to extremely small voltages and never attempt to test its operation by connecting a battery to the terminals. Even the voltage of a dry cell is many times that required for full-scale deflection and at the least a bent pointer will result. Burned springs or an open moving coil are more likely to follow such a procedure.

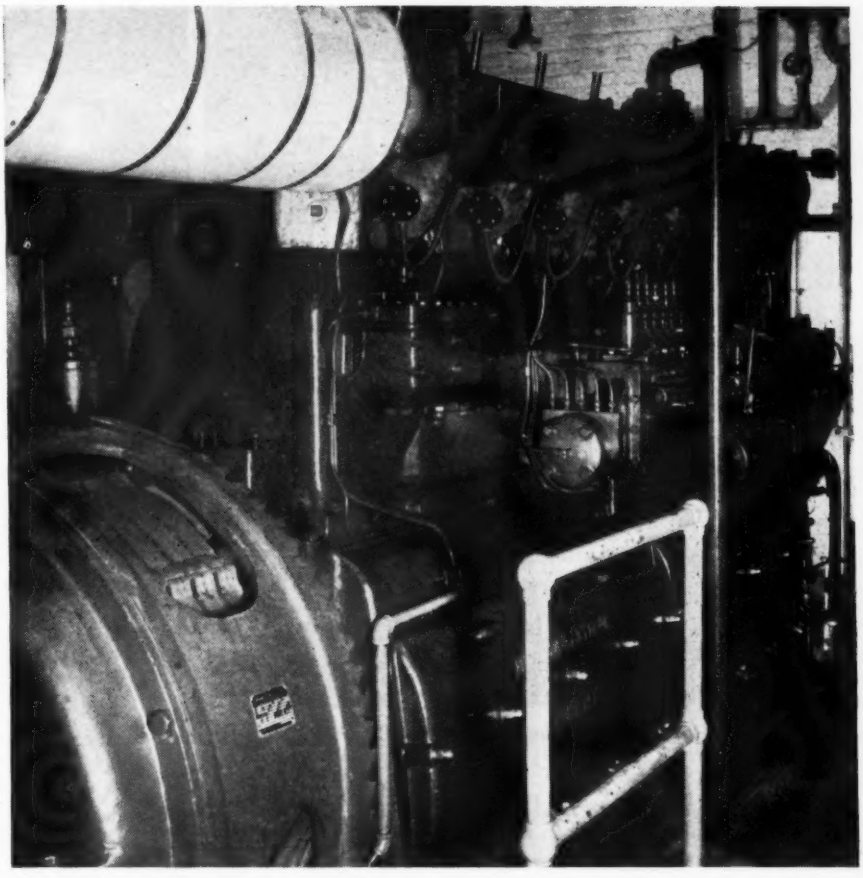


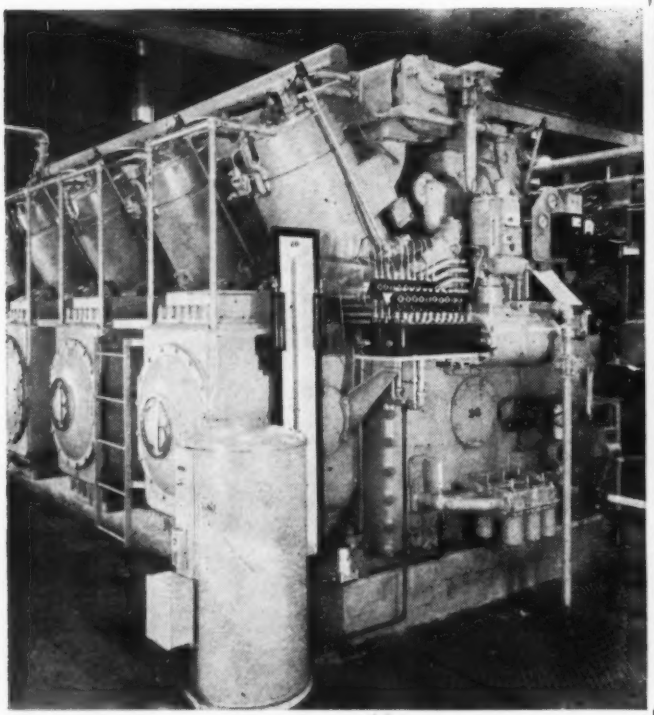
Fig. 3—Individual thermocouple elements in connection from cylinders to exhaust manifold; BX leads carry extension wires to rigid conduit leading to the indicator

Pyrometers are available in a wide variety of forms. For installation on the engine, Fig. 4, some form of shockproof mounting is often supplied. Many engineers prefer to mount the pyrometer indicator with other instruments on a separate panel adjacent to the engine, Fig. 5. Portable units have prods for contacting terminals of insertion thermocouples mounted in the exhaust pipes. Designed for the appropriate temperature range, pyrometers are also used to measure temperatures other than of the exhaust—cooling water and lubricating-oil temperature, for example.

Mere observation of exhaust condition—watching for smoke—may seem unscientific, but in the early days the only instruments an operator had were his eyes and ears and even today a skilled operator can tell much about engine performance by looking at the exhaust. A clear exhaust shows clean combustion; if exhaust is smoky, high fuel consumption and troubles from soot deposits can be predicted with practical certainty. To be more specific, black smoke spells incomplete combustion; blue smoke usually indicates excessive cylinder lubrication. In turn, incomplete combustion may result from maladjustments or mechanical defects, or from an attempt to burn more fuel in the cylinder than it will take—in other words, overloading.

Exhaust smoke can be judged best against a blue-sky background, but even then quantity of exhaust, observation distance and personal elements prevent strictly accurate observations. On a cloudy day, or in absence of sky background, visual observations are less trustworthy, and at night impracticable. This has lead to development of a number of *smokemeters*, most of them operating on photoelectric principles. Fig. 6 illustrates an easily built device of this kind, developed in the diesel laboratory of The Pennsylvania State College and described in detail in POWER, Nov, 1941, p. 800.

The meter consists of an 18-in. tube, about 1¾ in. ID, with a glass window at each end. One end carries a 200-watt projector lamp and an adjustable shutter (a camera shutter will do) while the other end carries a photocell lightmeter similar to those used for measuring



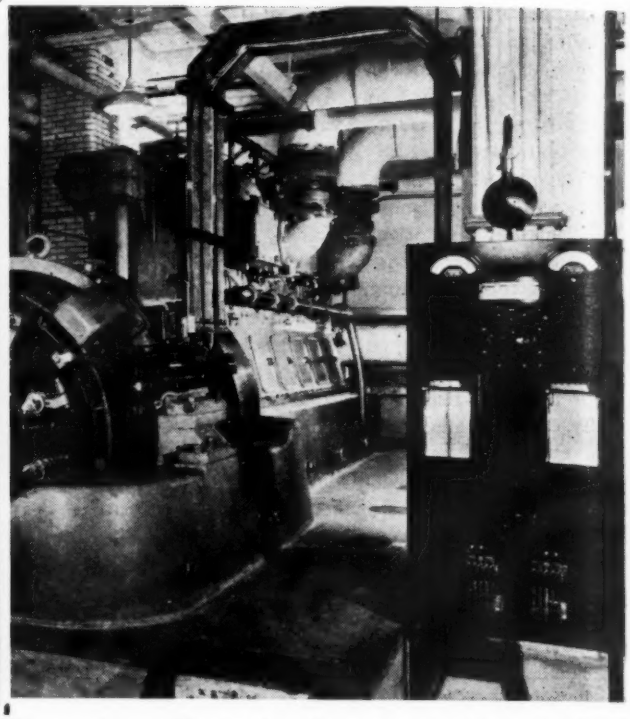


Fig. 4—Pyrometer indicator and selector switch may be mounted on engine or, Fig. 5—On adjacent separate instrument board

room illumination. It is advisable to hinge both windows or make them demountable for easy cleaning. Instead of the shutter, a rheostat may be used to change light intensity by regulating voltage.

Copper tubing ¼ in. in diameter carries exhaust to the smokemeter tube, which opens to atmosphere through two rows of eight 1/16-in. holes. To measure smoke density, scavenge the tube with air and adjust shutter or rheostat to bring lightmeter reading to 50 foot-candles. Then admit engine exhaust and read lightmeter, allowing about 30 sec for stabilization. If smoke reading is x foot-candles, smoke density is figured by dividing x by 50 and subtracting the result from 1. To express density in percent, multiply by 100. For example, assume smoke reading is 30. Dividing by 50 gives 0.6, and subtracting from 1 yields 0.4. The smoke density is 40%. In formula form:

$$100\ (1 - \frac{x}{50}) = \text{smoke density, percent.}$$

Adjust Shutter

If windows become obscured during tests, or light source changes intensity, adjusting shutter or rheostat to bring lightmeter to 50 foot-candles with free air neutralizes the effect. Results are independent of light-source intensity, lightmeter sensitivity, deposits on windows, gas velocity, area of smokemeter tube and point where connecting tube enters exhaust manifold. The only factor that enters—besides the smoke density—is the tube length, which can be conveniently standardized at 18 in.

Fig. 7 shows a typical smoke-density record. Between 25 and 75% load, smoke density is practically zero, and beyond 75%, density increases slowly. After normal full-load point is passed, smoke density increases rapidly. Against a normal blue-sky background, smoke just begins to become clearly visible when the smokemeter registers 50% density.

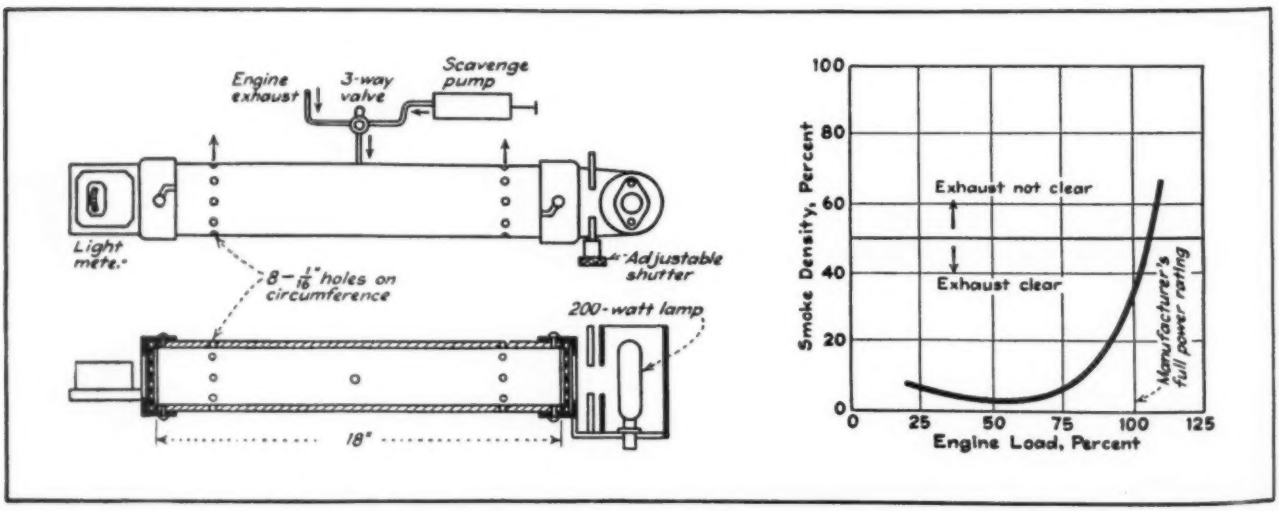
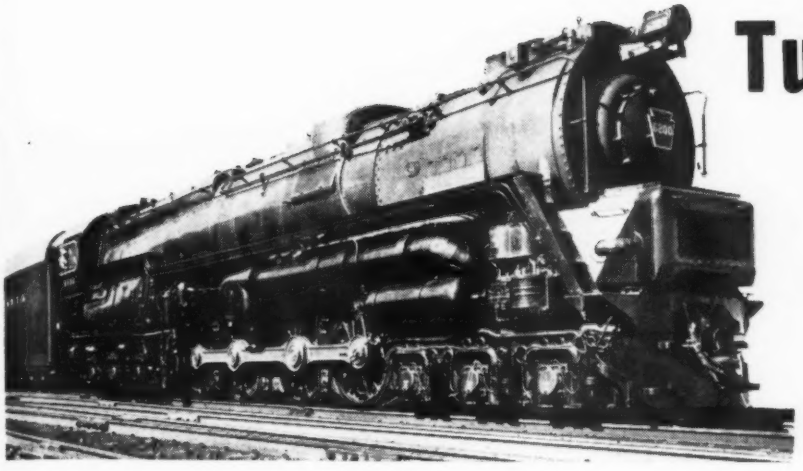


Fig. 6—Exterior view and section of smokemeter. Fig. 7—Typical smoke-density readings plotted against engine load

Casey Jones Turns to Turbine Power



Recent engineering and manufacturing developments aid in solution of mechanical problems in construction of geared-turbine locomotive. Here are design highlights*

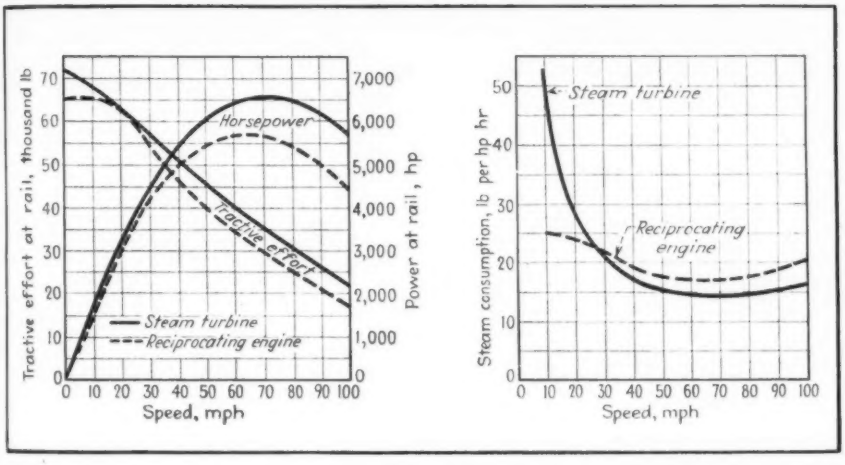


Fig. 1—Tractive effort and horsepower at rail plotted against speed for both turbine and reciprocating locomotives

Fig. 2 Steam consumption of turbine unit is poor at low speeds but better than reciprocating engine at high mph

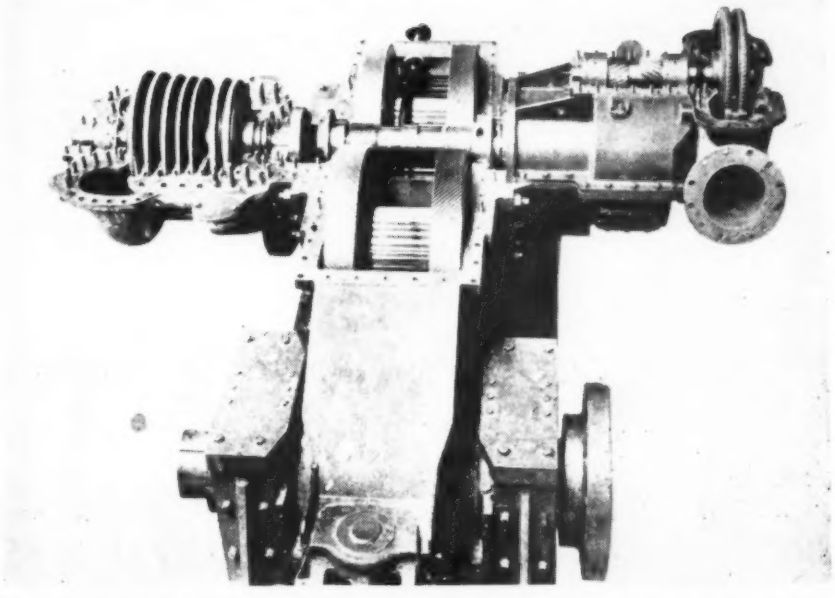


Fig. 3—Suspended between two of main drive axles, power unit consists of forward turbine *(left)*, reduction gear *(center)* reverse turbine and clutch *(right)*

► In 1937, the Pennsylvania Railroad became interested in the possibility of improving standard passenger-locomotive performance by replacing the reciprocating engines with a geared turbine. Two years of study convinced Westinghouse and Pennsylvania engineers that such a design was practical and worth while but that cost of modifying existing units made construction of a new high-speed locomotive preferable.

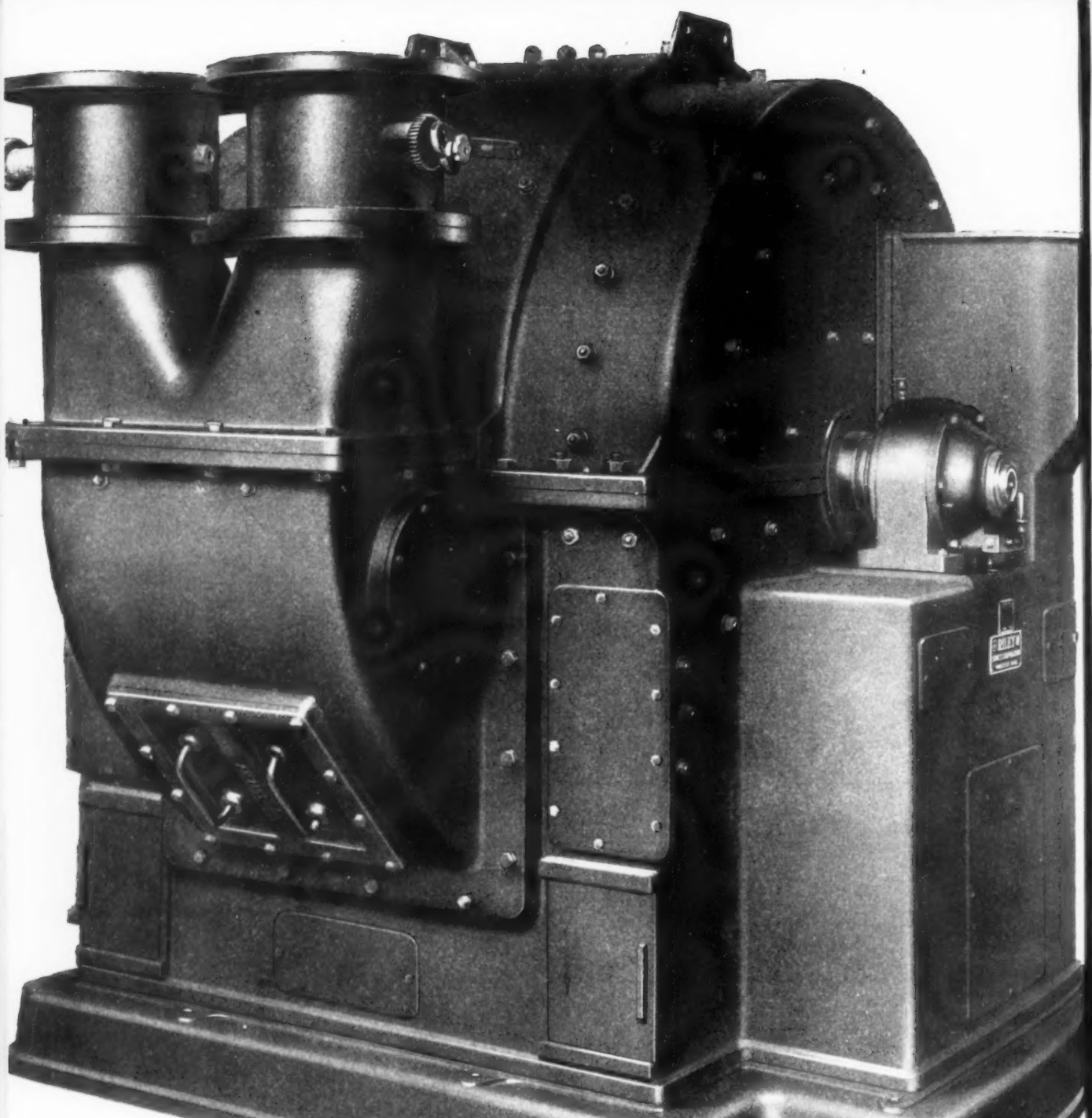
Accordingly, in 1941, when engineers of Westinghouse, Baldwin Locomotive Works and the Pennsylvania had completed designs for such a power plant, work started on a 6900-hp locomotive for high-speed freight or passenger service, this rating being considered highest practicable for a rigid-frame 4-driving-axle unit. With some changes to utilize non-critical materials and manufacture on a limited scale, the unit was delivered by Baldwin Locomotive Works in Sept. 1944. It is now undergoing main-line trials.

What advantages does the geared-turbine locomotive offer? Compared to the 2-cyl reciprocating unit, it provides: 20% more power from a given boiler, smaller driving wheels and lower center of gravity, uniform torque without reciprocating parts, dynamic augment and unbalanced forces. Fig. 1 compares tractive effort and horsepower at the rail; Fig. 2 shows steam consumption per hphr at various speeds.

The power plant that makes possible these advantages is the result of engineering advances having significance in

(*Continued on page* 98)

* *Abstracted from articles by J. S. Newton, asst engrg mgr, steam division; W. A. Brecht, mgr transportation engrg, transportation & generator division; and Charles Kerr, Jr, consulting transportation engr; Westinghouse Electric & Mfg Co*



No. 5 Duplex Riley Pulverizer
Capacity—10 tons Pittsburg No. 8 Coal
Overall Dimensions—Width 9'3"
Length 8'6"
Height 8'0"

RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Washington Buffalo Cleveland Detroit Chicago St. Louis Cincinnati
St. Paul Kansas City Denver Seattle Portland Los Angeles Houston New Orleans Atlanta Memphis

It will pay you to visit modern Riley Installations

Riley Pulverizers More Popular today than ever before

Here are a few of the reasons for Riley Pulverizer popularity

- **Flexibility—Wide Load Range**

  Extremely fluctuating loads over a wide range are easily carried. Under favorable conditions, continuous firing has been maintained at such a low rate that no steam was generated by the boiler. Load ranges of 10 to 1 are carried at many Riley installations.

- **Low Power Consumption**

  With Riley Pulverizers, coal is first crushed to a granular state and then finely pulverized. This two-stage principle of pulverization partly explains the reason for the low power consumption of Riley Pulverizers. Another reason is the fact that but little power is required to run Riley Pulverizers when running idle. This means very low power consumption at lower loads.

- **Sustained Fineness of Pulverization**

  Wear of pulverizing elements of Riley Pulverizers occurs in such a manner as to have but slight effect upon fineness of pulverization throughout their life. A mechanical separating device further assures proper degree of fineness by mechanical rejection of coarse particles.

- **Quiet, Vibrationless Operation**

  You will undoubtedly be surprised by the quiet vibrationless operation when you first see a Riley Pulverizer in operation.

- **Ability to Handle Wet Coal**

  Riley Pulverizers efficiently handle high moisture coals not only because high temperature air can be used, but because nowhere in the pulverizing process is the coal crushed between two surfaces, but throughout is held in suspension, making possible the most effective use of drying air. Primary air mixes immediately with the coal.

- **Reliability**

  The reliability of Riley Pulverizers has been thoroughly established by performance of hundreds of these machines during the past fifteen years.

- **Ease of Lighting**

  It is easy to light a Riley pulverized coal burner. The design of the Riley burner assures uniform distribution of alternate layers of lean and rich mixtures of coal and air, affording rapid ignition when starting fires.

- **Low Maintenance**

  Recent improvements in design have even further reduced the maintenance of Riley Pulverizers. It is also easy and simple to make repairs to Riley Pulverizers. There are no large or heavy parts to replace.

Riley Pulverizers are used by these outstanding plants

Public Utilities —

Pennsylvania Edison Co.
Connecticut Power Co.
Hartford Electric Light Co.
Iowa-Illinois Gas & Electric Co.
Oklahoma Gas & Electric Co.
Southern Ind. Gas & Electric Co.
Potomac Electric Power Co.
Union Electric Co. of Ill.
Carolina Power & Light Co.
Central Ohio Light & Power Co.
Lynn Gas & Electric Co.
United Illuminating Co.

Industrial Companies —

General Electric Co.
Winchester Repeating Arms Co.
Scovill Manufacturing Co.
Standard Oil Co. of Ind.
Curtiss-Wright Corp.
Western Cartridge Co.
Standard Oil Co. of N. J.
Norton Company
Forstmann Woolen Co.
Dow Magnesium Co.
Kellogg Company
Beechnut Packing Co.
Henry Disston & Sons Co.
Allis Chalmers Mfg. Co.
National Lead Co.
National Cash Register Co.
Carbide & Carbon Chemical Co.
Johns-Manville Co.
Nicholson File Co.
Wheeling Steel Corp.
R.C.A. Mfg. Co.
Carnegie-Illinois Steel Co.
Heywood-Wakefield Co.
Bell Aircraft Co.
Celanese Corp. of America
Crompton & Knowles Loom Works
General Motors Corp.
Crown Cork & Seal Co.
General Machinery Corp.
Diamond Magnesium Co.
Publicker Comm. Alcohol Co.

A survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in power costs

COMPLETE STEAM GENERATING UNITS

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS
ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

before purchasing Boiler or Fuel Burning Equipment

Casey Jones Turns To Turbine Power

(*Continued from page* 95)

fields other than the railroad. The turbine embodies developments from recent marine practice; hardened and ground double-helical gearing finds first commercial use and tooth loading of high-speed pinion is practically double that ordinarily used.

Known as Pennsylvania Class S-2, this 6-8-6 noncondensing locomotive has a conventional 95,000-lb-per-hr 310-psi 750-F firetube boiler. At this steam flow, the turbine unit develops 6550 hp at the rail at 70 mph. Fig. 1.

The propulsion unit and controls include a forward turbine; double-reduction gear for each of two middle-driving axles; flexible cup-drive elements between final drive gears and middle-driving axles. Fig. 4 and 5; and a reverse turbine and gear unit clutched to the single high-speed pinion, Fig. 6; pneumatic steam-admission control with overspeed and low-oil-pressure protection, and the various lubrication-system auxiliaries.

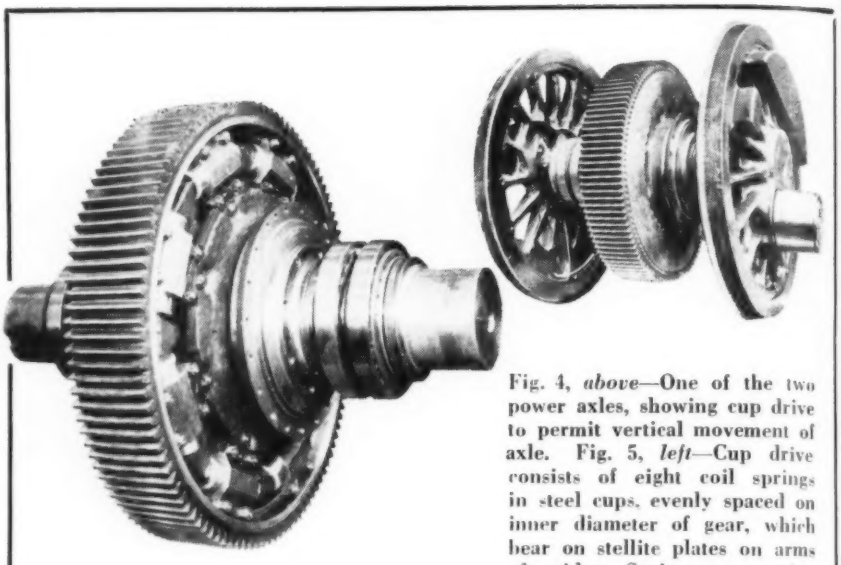
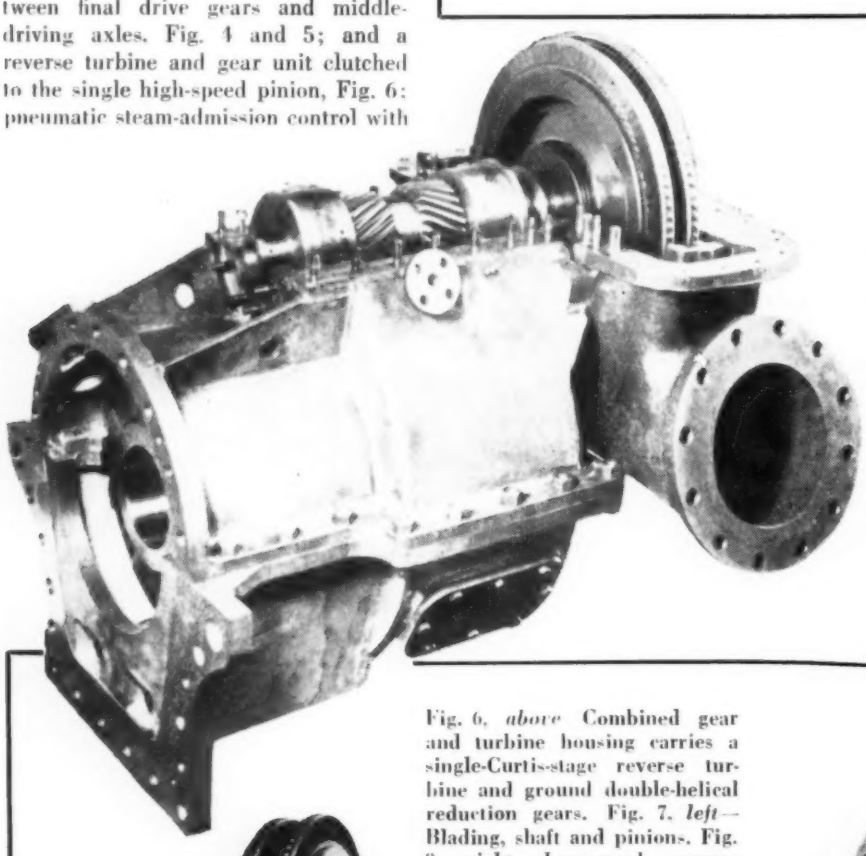


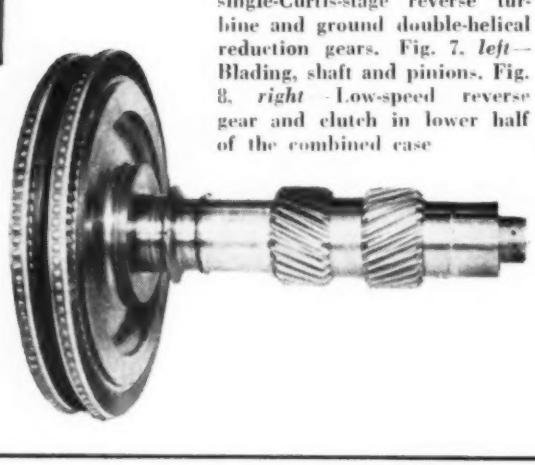
Fig. 4, *above*—One of the two power axles, showing cup drive to permit vertical movement of axle. Fig. 5, *left*—Cup drive consists of eight coil springs in steel cups, evenly spaced on inner diameter of gear, which bear on stellite plates on arms of spider. Spring compression permits torsional flexibility



Both turbines are supported from the gear case, Fig. 3, which is, in turn, supported from the main locomotive frame at three points, in such a manner that distortion of the frame is not transmitted to the gear case.

The forward turbine, of impulse type with a Curtis stage followed by five full-admission Rateau stages, is similar to high-pressure units of cross-compound marine plants, specially designed to meet severe temperature and load changes of railway service. At 100 mph, turbine rotates at about 9000 rpm. It connects to the high-speed pin-

(*Continued on page* 150)



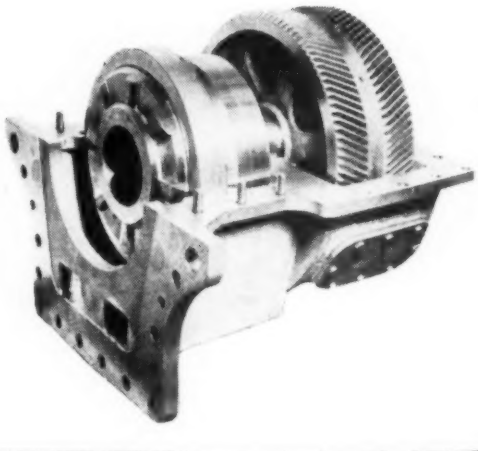


Fig. 6, *above* Combined gear and turbine housing carries a single-Curtis-stage reverse turbine and ground double-helical reduction gears. Fig. 7, *left*—Blading, shaft and pinions. Fig. 8, *right*—Low-speed reverse gear and clutch in lower half of the combined case

AMERICA WANTS PROSPERITY

A BOOK to be published early in April by the McGraw-Hill Book Company carries the provocative title "Prosperity: We Can Have It If We Want It." Its authors, Messrs. Shields and Woodward, state in vigorously challenging terms their conviction that the United States will emerge from war with human, material and technological resources adequate to provide a nation-wide standard of living unprecedented in world history. They present, too, their formulation of the several policies and procedures which must be followed by government, business, and labor if we are to realize our potential for a high and sustained prosperity unmarred by prolonged periods of severe unemployment and business stagnation such as have haunted our economic past.

The specific proposals set forth will elicit both enthusiastic acclaim and acrid dissent, for the book deals in far from gentle fashion with many of the currently fashionable panaceas for assuring prosperity by magic formula. It examines, and discards as effective guarantors of prosperity, whatever their individual merits upon other grounds, programs for public works, slum clearance, subsidizing of small business, foreign loans, social insurance, deficit government spending, redistribution of income, the numerous formulae for monetary management, repeal of the anti-trust laws, or any of the loosely-phrased admonitions that government should do nothing and allow everything to take its course untrammeled by controls of any kind.

On the positive side, the book urges clear recognition of the fact that prosperity, under a system of business enterprise, depends primarily upon the existence of competitive incentives that spur capital investment to provide better tools and equipment, that improve organization and technology to insure continuously increasing productivity per man-hour of work, and that enlarge markets by producing what the consumer wants at lower prices to the end that real incomes may be increased.

In short, prosperity depends upon profitable and expanding business and employment opportunity, so it becomes the part of enlightened government, business, agriculture and labor policy to promote those measures which will forward rather than retard the major aim of expanding production.

However great the room for dissent upon the adequacy, or the phrasing, of the specific recommendations it makes, the approach of this book has one virtue of solid merit. It attacks positively the problem of what steps should be taken to achieve and hold prosperity rather than merely devising a poultice to be applied when and if we run into a decline.

Virtually all responsible spokesmen for government, and for business, labor, and agricultural groups, are agreed upon the goal of prosperity. Moreover, they agree that, insofar as possible, it should be achieved through the effort of private enterprise, with government intervention utilized only as a last resort. But despite this unanimity, almost all public discussion of the problem has concentrated upon the nature, the extent, and the timing of such government expenditures as may be found necessary to combat deflation. Since upon this question there is far from general agreement, our procedure has created an exaggerated sense of divergence in a field in which, so far as fundamentals go, we all are in accord to quite an unusual degree.

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No confusion should be caused by the fact that the generally current phrase for prosperity is "full employment." The latter phrase merely states the goal in terms of human values, which are good terms in which to state any goal. What matters is that we generally are agreed as to what we mean when we say that we want prosperity or full employment. Not only do we know what we mean, but within very rough limits we can give dimension to our concepts. There are a few whose appraisals are somewhat lower, but most competent estimators set the goals for about 1950 at an average annual employment in civilian jobs of between 55 and 57 million persons, with a gross national product of between $185 and $200 billion measured at 1943 price levels. This contrasts with the 1944 level of non-military employed of 51½ million, and a gross output for the end of 1944 of over $200 billion. It assumes a reduction of the average workweek to 40 hours.

It will take some such levels as these to provide employment for those who seek work, with only sufficient "frictional" unemployment (those temporarily listed as unemployed because of the normal turnover between jobs) to afford reasonable labor-market flexibility to both workers and employers. The non-military employment figures are generally consistent with the officially stated postwar goal of jobs for 60 million workers, since the latter figure is generally understood to be an estimate of the *labor force,* which includes members of the armed services and an allowance for frictional unemployment.

There are a number of reasons why the estimates cannot be figured more closely, and why no one can be very confident even of the validity of the stated limits. The chief points of doubt in the employment estimates relate to how many withdrawals there are likely to be on the part of women, oldsters, and youngsters, who now are in the labor force to a number more than 6 millions beyond normal expectancy; how many men will be retained in the armed forces; and whether the

postwar frictional unemployment should be calculated as approximating the current 1 million or the 3 million so-listed in the prosperous year of 1929. Additional uncertainties cloud the estimates of gross national product. Notable among them is the fact that no one is sure of the war's effect upon man-hour productivity trends, in view of the fact that half of our current output has consisted of products that had no substantial counterpart in our peacetime price or production series.

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Nevertheless, despite such qualifications, it is fair to say that we do have a general conception of the magnitude of our postwar goals. Although they are well within our production potentials as demonstrated in this war, they are formidably beyond any previous record of peacetime achievement. Only the most sanguine optimism could lead one to expect that they will be achieved without concerted will, planning, and cooperative effort. Only blind recklessness could engender confidence that once attained they will automatically be held, let alone expanded in normally healthful growth.

If we were to follow past patterns, our war-built boom would, after a period of uncertain length, collapse into disastrous depression. The very magnitude of our recent growth would contribute to the depth and duration of the subsequent trough. Yet a fall even to the level of our previous peacetime-peak-year 1939, has been estimated by The Federal Reserve Board to imply unemployment for between 15 and 20 million persons. If human values have importance, that is something that must not be allowed to occur. If business values have importance, we must not tolerate again such losses as occurred from 1930 to 1933, when sales over the four year period were $128 billion less than would have been provided if the 1929 level had held, and corporate profits declined from more than $7 billions in 1929 to an average annual loss of $1 billion over the next four years. A repetition of these things cannot be tolerated—*if foresight and cooperative effort can prevent them.*

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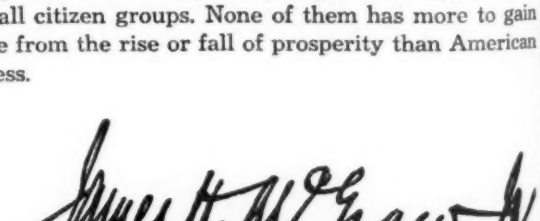
In January of this year Senator Murray introduced in the Senate a bill entitled "The Full Employment Act of 1945." It instructs the President to submit to Congress plans for eliminating both unemployment and inflation, including recommendations for correcting structural defects in the economic system. It provides for a Joint Congressional Committee to consider the proposals of the President, to take testimony from experts and the general public on these proposals or any others it may wish to consider, and after weighing all the facts to submit its findings to Congress. It provides for an advance budgeting of the constituent parts of a full-employment economy, and commits the Federal Government to provide, in advance, for sufficient expenditures (through private contractor channels) to make up for the gap between estimated private expenditures and the amount necessary to assure full employment.

By no stretch of the imagination can The Full Employment Bill, in its present form, be regarded as acceptable to business. Yet it may well present a test of whether or not American business can deal with problems in this area in a statesmanlike fashion. Such statesmanship will consist in demonstrating first, that the Bill is not acceptable because of deficiencies which preclude the possibility of its accomplishing the avowed purposes; and second, that business is able and anxious to offer constructive suggestions for remedying these deficiencies.

It is easy to point to weaknesses in the Bill. To mention only a few of major importance: The proposal to make advance Federal expenditures to compensate for estimated deficiencies in prospective private expenditures is completely impracticable. No one in the country can predict future trends with sufficient accuracy for this purpose; no one can tell what the constituent parts of a really high, *stable* peacetime budget should be, for in our boom-or-bust economy we have no stable pattern to project; no one can tell, within reasonable limits, how much the government should spend *in advance* to assure full employment. The Bill pronounces labor's right to work without defining commensurate responsibilities which it should exercise. It does not define the areas of proposed government expenditure in such a way as to allay business fears of government competition or the general public suspicion of leaf raking. Above all, the Murray Bill is defective in that, despite a somewhat vague pronouncement in favor of forwarding private business activity, it recommends a single specific designed to supplement such activity rather than stimulate it.

The very definition of certain of these faults suggests their remedies. But the positive task of stating how the Bill should be amended in order that it may have effective usefulness is far from simple. Yet it is enormously to the advantage of American business to undertake it. Fortunately, there is a representative group sponsored by industry, The Committee for Economic Development, which has for some time been working intensively upon the problem, and which is excellently equipped to offer sound and progressive advice. It should be used for this purpose.

American business cannot afford to take a negative attitude toward legislation in this field. Some legislation undoubtedly will pass, for the problem is one in which there is a grave government responsibility. But equally there is a comparably important responsibility upon all citizen groups. None of them has more to gain or lose from the rise or fall of prosperity than American business.



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THIS IS THE 34TH OF A SERIES

'General Staff' Plans Strategy of Fuel Front

Washington meeting of National Fuel Efficiency Council and Bureau of Mines officials. Seated, left to right: J E Tobey, managing dir, Fairmont Coal Bureau, New York; R A Sherman, supervisor, fuels div, Battelle Memorial Institute, Columbus, O.; H K Kugel, smoke regulation engineer, Washington, D. C. Of Bureau of Mines: J F Barkley, chief, div of solid fuels utilization for war; Dr A C Fieldner, chief, fuels and explosives branch; T C Cheasley, supervising engineer, national fuel efficiency section; Dr R R Sayers, Bureau director. W G Christy, smoke abatement engineer, dept of smoke regulation, Hudson County, Jersey City, N. J.; O F Campbell, combustion engineer, Sinclair Refining Co, East Chicago, Ind.; C A Reed, director of engrg dept, National Coal Assn, Washington, D. C.; C F Hardy, manager, fuel engrg div, Appalachian Coals, Inc, Cincinnati, O. Standing, left to right: S M Walker, and H J C MacDonald, mining engineers; Kenneth M Waddell, asst supervising engineer; F M Howard, fuel engr; Fay D Edwards, administrative asst; J H Burton, information specialist; G M S Tait, analyst; R E Morgan and G M Hayes, fuel engrs—all of the Bureau's national fuel efficiency section

▶FUEL SAVINGS ranging from 3 to 35% in industrial plants, office buildings, schools and colleges, apartment houses, government buildings and other commercial consumers of coal were reported at a recent meeting of the National Fuel Efficiency Council and Bureau of Mines officials in Washington, D. C., according to Dr R R Sayers, Director of the Bureau.

Nearly 10,000 plants throughout the country have been visited and surveyed by volunteer engineers working in the National Fuel Efficiency Program, which is sponsored by private industry and the Bureau of Mines, the Council was informed. Pledges of cooperation have been signed by operators of these plants, and a "waste chaser" has been appointed in each plant to put into use the technical information provided by the Bureau of Mines and the volunteer engineers.

To offset at least a part of the 1945 deficit in fuel production is the objective of the National Fuel Efficiency Program. At the outset of the campaign, a goal was established to save 29 million tons of coal each year and proportionate amounts of oil and natural gas through more efficient utilization by industrial and commercial consumers. Substantial progress toward this goal was disclosed at the meeting of the council, which is composed of some of the nation's leading fuel and combustion engineers.

Indicative of the wide range of fuel consumers cooperating, a distribution breakdown of 1300 pledges signed in seven areas—Albany and Buffalo, N. Y.; Cincinnati and Springfield, O.; and Peoria and Elgin-Aurora, Ill.—shows that schools and colleges represent 19.6%; apartments, 4.2%; hotels, 2.5%; banks, stores, offices and theaters, 13.9%; laundries and dry cleaners, 1.7%; telephone exchanges, post offices and libraries, 4.7%; Y.M.C.A.'s, clubs, hospitals, churches and other institutions, 8.7%; plants, power plants and factories, 35.8%, and installations not identified, 8.9%.

Public Buildings Administration, Federal Public Housing Authority, and other federal agencies also are cooperating and are obtaining results, a report submitted at the meeting disclosed. Representative savings this year over last in Washington, D. C., office buildings, compiled on a degree-day basis, showed 25% for the Public Buildings and Administration's ABC group of buildings, 20% for the Hydrographic office, 30% for Navy, 33% for Munitions, and 16% for Temporary 8 Building.

Still expanding their field organization, the directors of the National Fuel Efficiency Program now have appointed 181 area coordinators throughout the country with supervision over 5000 regional engineers, all volunteers from industry. Coordinators, in turn, have appointed 726 persons to their advisory committees. Thirty-four "quiz sheets," providing fuel-efficiency information for different types of installations, have been printed, two more are being printed, and twelve others have been prepared.

Low Steam Cost Starts With the Fuel Survey

Failure to select equipment to handle all fuels readily available too often means trying to feed a champagne appetite on a beer purse. Recommending fuel surveys to dodge such troubles, Tom Marsh, Iron Fireman Corp, presents a new coal classification and its use

► BUILDING A POWER PLANT without first surveying the locality's entire fuel market is like buying a railroad ticket before deciding where you're going—it can be done but there isn't much sense to it. Yet fuel-burning equipment is often selected in just this haphazard way. Some of the few surveys made have lacked completeness, due to overlooking important fuel sources. Moreover, common terms describing coal quality prove loose and even misleading. Here is a new classification of coals and data showing how low steam costs result when plant design takes advantage of attractive fuel purchases.

Good and *poor* coal are vague and purely relative terms. Good coal of one area is often poor in another—coal called poor in West Virginia may look good in Illinois, while Illinois poor coal may look good in Iowa. Also, the so-called good coal becomes a poor one if the burning equipment is found to be unsuitable.

A more rational classification for individual producing and consuming areas uses the terms *standard, premium* and *economy* to describe relative fuel values. Of course, for each area the relative values change because of differences in production, transportation, trends in fuel-burning equipment, and other factors. Probably no market does or ever will show a fixed or constant coal supply that permits rigid classification. However, these proposed terms, as the following definitions indicate, are by their nature less likely to display wide divergences from area to area.

Standard coals in any district, because of their properties and characteristics, are widely used and produce satisfactory results in the average coal-burning installation. Standard coals thus establish an average price per million Btu.

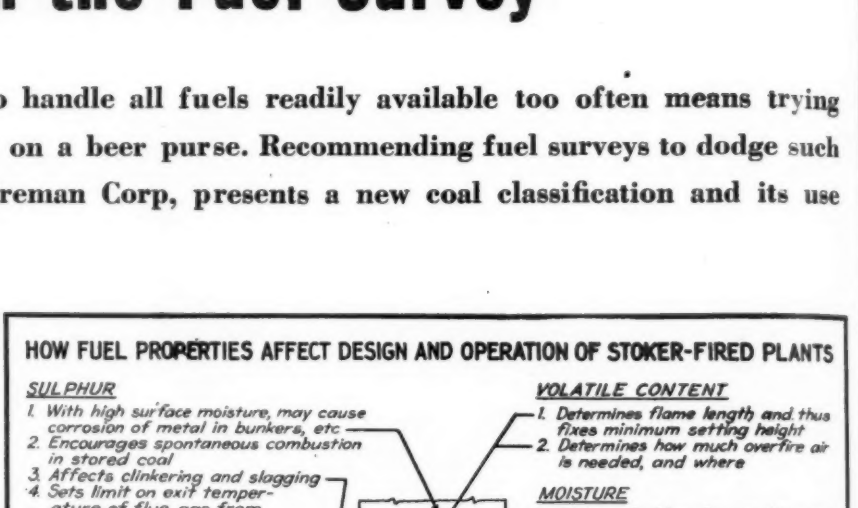
Premium coals, as a result of favorable properties and characteristics, are used in those services unable to obtain satisfactory results with standard or economy coals. Thus these coals command a higher price per million Btu than standard or economy coals.

Economy coals have a more limited utilization and therefore sell at a price giving more Btu's per fuel dollar than standard coals.

In certain areas, economy coals may have higher quality than premium coals of another area. Moreover, as conditions vary over a period of time in some areas, an economy coal may become a standard and conceivably a premium coal. Also these terms have a separate and distinct application in the industrial, commercial and domestic fuel-burning fields. To sum up: these terms are relative, and have value only at a specific place and time.

Characteristics that classify coal in any district include *relative* heating value, ash content, moisture and hydrogen content, ash-fusion temperature, sulphur content, storage and degradation properties, size, size consist, (see page 102) and grindability. The qualifying adjective *relative* applies because the buyer must consider these characteristics for each coal in relation to other coals in the market.

Because premium coals do command a higher price per million Btu's than standard and because economy coals offer more Btu's per dollar than do standard, the plant that burns economy coals satisfactorily enjoys a definite advantage in low-cost steam production. Generally, standard or premium coals may be substituted for economy coals, which thus offer complete flexibility. Typical exceptions exist in the fact


HOW FUEL PROPERTIES AFFECT DESIGN AND OPERATION OF STOKER-FIRED PLANTS
SULPHUR
1. With high surface moisture, may cause corrosion of metal in bunkers, etc
2. Encourages spontaneous combustion in stored coal
3. Affects clinkering and slagging
4. Sets limit on exit temperature of flue gas from air preheater
VOLATILE CONTENT
1. Determines flame length and thus fixes minimum setting height
2. Determines how much overfire air is needed, and where
MOISTURE
1. Reduces fuel-handling and burning capacity; may cause handling difficulties (freezing, etc.)
2. Must be evaporated in furnace, causing "moisture loss"
3. Surface moisture may prove beneficial to structure of fuel-bed (as in "tempering")
SIZE
1. Handling equipment should be designed to avoid size segregation
2. Size, along with caking qualities, affects density of fuel-bed and uniformity
3. Fuel-bed density affects amount of draft needed and distribution
4. Excessive quantities of fines may cause high carbon loss to ashpit and stack
ASH CONTENT AND FUSION TEMPERATURE
1. Presence of ash reduces handling and burning capacity; may increase handling cost
2. Amount of ash, fusion temperature and ash composition, in relation to burning rates, fuel-bed and furnace temperature, indicates possibilities of clinkering and slagging. Some ash needed to protect grates
3. Equipment needed for ash removal; disposal may involve cost. High ash usually means high carbon loss to ashpit
CAKING AND COKING
1. Stoker should agitate fuel-bed in proportion to caking tendency
2. Fuels forming weak cokes better for fluctuating loads

that low-ash coals may cause high maintenance on some stokers and that high-ash-fusion coals prove less applicable to slag-tap pulverized-fuel furnaces.

Since, therefore, economic advantage points to designing plants to utilize economy coals, let's look at chemical and physical properties that classify coals as standard, premium or economy.

Relative heating value (Btu content) does not in itself govern classification because a high-heat-value coal may have other properties unfavorable to wide utilization compared to alternates. Conversely, a low-heating-value coal may display such other favorable characteristics as to rate in the premium class and justify a higher price per million Btu's.

Relative ash content is important because ash, a non-combustible, displaces combustible matter. Thus, in general, higher ash coals show lower heating value than lower ash coals, and more tons must be burned to liberate the same equivalent heat. In addition, each ton burned has a higher ash content so that the total ash and refuse to dispose of is increased in two ways.

Burns More Coal

The buyer of high-ash coal not only burns more coal (pounds) to obtain a given heat release, but pays freight and handling on unburnable matter. On top of that he pays for disposing of a greater amount of refuse. Higher total hourly coal entails either higher burning rates per sq ft of stoker-grate area, or larger grate areas. Engineers usually follow the latter procedure as higher burning rates result in more ash disposal from each sq ft of grate.

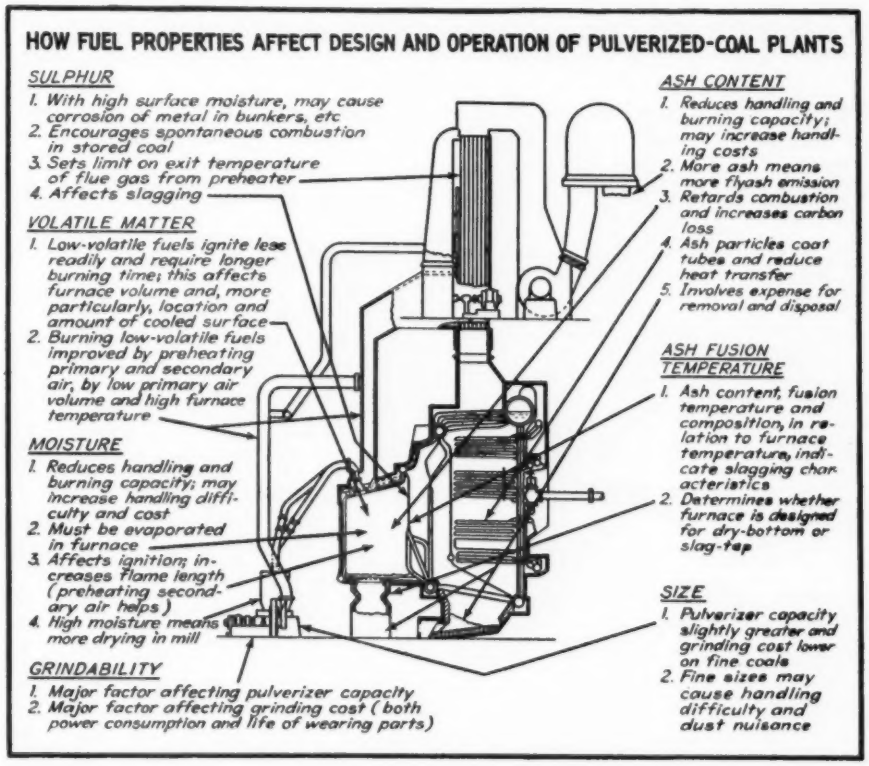
Relative moisture and hydrogen content: Moisture is also a non-combustible constituent. High moisture lowers heat content; moreover, some of the heat goes to evaporate the moisture and raise it to exit temperature. This proves of slight significance unless moisture content rises considerably above that of other available fuels. Wet coal causes difficulties in handling, also in bunkers and stoker-feeding mechanisms. Offsetting this is the fact that on some stokers, as chain grates, *tempered* coal has favorable burning characteristics.

Hydrogen in coal combines with oxygen to form water vapor (steam) which must also be raised to exit-gas temperature. This represents a loss greater than that due to moisture.

Moisture and hydrogen content must be evaluated against the amounts in other available coals. Because both detract from net effective heating value, the buyer must consider burning rates as for ash, above.

Relative ash-fusion temperature: Low ash fusion relates here to coals causing slagging and clinkering at furnace temperatures whether the result of low-*fusion* or low-*fluid* temperature. Low-ash-fusion coals generally fall into the economy classification.

Provision for satisfactory burning of low-fusion coals must be made in initial selection of burning equipment and its proportions. For stoker-fired plants, the engineer must consider grate-area requirements and make sure that sufficient exposed black surface is installed to reduce furnace exit temperatures to a point below ash-softening temperature. In pulverized-fuel plants, slag-tap furnaces are indicated for low-fusion coals and dry-bottom for high.


HOW FUEL PROPERTIES AFFECT DESIGN AND OPERATION OF PULVERIZED-COAL PLANTS
SULPHUR
1. With high surface moisture, may cause corrosion of metal in bunkers, etc
2. Encourages spontaneous combustion in stored coal
3. Sets limit on exit temperature of flue gas from preheater
4. Affects slagging
VOLATILE MATTER
1. Low-volatile fuels ignite less readily and require longer burning time; this affects furnace volume and, more particularly, location and amount of cooled surface
2. Burning low-volatile fuels improved by preheating primary and secondary air, by low primary air volume and high furnace temperature
MOISTURE
1. Reduces handling and burning capacity; may increase handling difficulty and cost
2. Must be evaporated in furnace
3. Affects ignition; increases flame length (preheating secondary air helps)
4. High moisture means more drying in mill
GRINDABILITY
1. Major factor affecting pulverizer capacity
2. Major factor affecting grinding cost (both power consumption and life of wearing parts)
ASH CONTENT
1. Reduces handling and burning capacity; may increase handling costs
2. More ash means more flyash emission
3. Retards combustion and increases carbon loss
4. Ash particles coat tubes and reduce heat transfer
5. Involves expense for removal and disposal
ASH FUSION TEMPERATURE
1. Ash content, fusion temperature and composition, in relation to furnace temperature, indicate slagging characteristics
2. Determines whether furnace is designed for dry-bottom or slag-tap
SIZE
1. Pulverizer capacity slightly greater and grinding cost lower on fine coals
2. Fine sizes may cause handling difficulty and dust nuisance

While sulphur in itself does not lower ash-fusion temperature, it acts like the boy not bad himself but usually found in bad company. Sulphur combined with iron as iron pyrites (FeS_2) forms a common coal constitutent; it is the iron that lowers the fusion temperature. But sulphur may also be present in organic form as a sulphate that gives no slagging trouble. Thus sulphur is not an index of fusion temperature and coals high in organic sulphur but low in pyrites may have high fusion temperature.

Condensed sulphurous gases cause acid corrosion of preheaters, breechings, stacks, etc. The temperature at which condensation occurs increases measurably as percentage of sulphur in the gases rises. High-sulphur coals therefore do not permit the extent of heat extraction from combustion gas possible with low-sulphur coals. This limitation is quite definite and must be so treated.

Obnoxious sulphur content in smoke and its destructive effect on structures, textiles, etc, often violate air pollution and smoke-abatement laws, particularly in or near municipalities.

For all these reasons, many plants cannot burn high-sulphur coals, which often sell at economy prices compared to low-sulphur coals having a broader market. Under such conditions, more heat units may be purchased per dollar in the form of high-sulphur coals and the cost advantage may often outweigh loss due to lower efficiency. Therefore, plants that use high-sulphur coals satisfactorily enjoy a steam-cost advantage.

The heating plant of one large midwestern institution was originally equipped with economizers and air heaters to operate with final exit gas temperatures in the neighborhood of 300 F. Economic coals, in terms of heat units per dollar, showed 3 to 5% sulphur. Experience proved that such coals caused rapid air-heater corrosion and

set sulphur limit at approximately 1.5%.

Freight rate on these low-sulphur coals ran almost $1.00 per ton higher than on high-sulphur, and in addition, they were premium coals at the mine. After several years, operators removed the air heaters, raising exit temperature by about 200 F and thereby lowering efficiency. However, because of lower cost per million Btu of high-sulphur coals, net cost per 1000 lb of steam fell below that from premium coals burned at higher efficiency.

The existing plant of a midwestern industrial company handled economy coal at an attractive price per million Btu but needed replacement. A new boiler plant was installed to operate at substantially higher efficiency, but designers failed to make a thorough fuel survey. Consequently, it proved necessary to burn standard coals at higher cost. Annual fuel bills increased several thousand dollars over those of the original *less efficient* plant.

Numerous other cases show how initial plant design increased steam cost by making use of economy coals difficult or impossible. The hundreds of plants that have been and are being converted to equipment that burns more economical coals prove that all too often equipment is selected on inadequate fuel surveys, or none at all.

Relative storage and degradation properties: All coals can be stored but some deteriorate markedly; some show greater tendencies to heating and spontaneous combustion. U. S. Bureau of Mines bulletins and reports on coal storage offer much detailed information on this matter. In addition to weathering or slacking in storage, coal suffers size degradation in handling. Ability to resist degradation may be an important property in some applications.

Relative size and size consist: Most of the variables pertain to the smaller sizes and particularly to screenings and stoker coals. At one time, buyers specified screenings by top size only—2-in., 1½-in., etc. Then came the term *consist*, which designates the actual percentage of each intermediate size. For example, 1½-in. screenings could have:

3% of 1½- to 1-in. size
4% of 1- to ¾-in. size
5% of ¾- to ¼-in. size
88% less than ¼-in. size

This would be a very poor consist because of excess fines. Another consist might reverse the picture, with coarse coal predominating. Still another might be a "doughnut" coal that has top and bottom sizes, with middle sizes screened out. To discuss size without consists is far from specific and apt to mislead.

Once engineers assumed that coal size did not affect the actual analysis but now they know that different consists of the same coal may show fusion temperatures that differ over a considerable range.

Some producers offer standard formulas for their consists based on best performance of their screening and can produce these consists regularly, repeating accurately the size formula, once established.

Power for Grinding

Grindability is a physical characteristic important to operators of pulverized-coal plants, serving as an index to the power needed to reduce coal to required size. This power is measured by a *grindability index*, on which coals most easily pulverized rate 100. Some coals show an index as low as 25. In addition to coal-structure characteristics, moisture and preparation affect grindability index, removal of refuse and pyrites raising the index.

Power to pulverize coal represents a substantial operating cost. If grindability index is low, pulverizing power is high. Mill maintenance also varies inversely with grindability index. Maintenance, in turn, affects mill efficiency and may be reflected in decreased combustion efficiency.

While grindability index is an all-important item in pulverized-coal plants, a low index may prove desirable elsewhere. This is particularly true with stokers because degradation should be low to maintain size consist. For long storage and rehandling, hard-structure coals are preferable for stoker-fired plants.

So much for fuel characteristics. What about equipment? Pulverized-fuel equipment may be adapted to the entire coal range, although furnace design must suit coal characteristics. No single design proves suitable for the entire range from bituminous to anthracite nor through a full range of fusion temperature, but it is possible, at slightly greater cost, to handle a wide range. In general, initial cost, auxiliary power and maintenance of pulverized-fuel installations exceed those of stoker-fired plants.

In the stoker field, traveling grates prove suitable for anthracite, free-burning bituminous and sub-bituminous, and lignite, with limitations on minimum ash. Underfeed stokers burn bituminous

(*Continued on page* 156)

TYPICAL ITEMS FOR A FUEL SURVEY

1. Name of coal: (state).....(seam).....(county).....(mine).....
2. Name of producer.....Address.....
3. Seam number.....Mine.....Shipping point.....
4. Size and size consist.....
5. Tonnage available .....
6. Reliability of supply now and in future years.....
7. Proximate analysis:....% H_2O....% Vol....% FC.....% Ash.....% Sulphur.....
8. Heating value—Btu per lb dry basis.....Btu per lb, as shipped.....
9. Ash-fusion temperature.....F Fluid temperature.....F
10. Grindability index..... Friability.....
11. Tendency to spontaneous heating.....
12. Cost per ton at mine..... $.....
13. Freight cost per ton..... $.....
14. Delivered cost per ton..... $.....
15. Cost per million Btu, as shipped..... $.....
16. Limiting exit temperature of flue gas..... .....F
17. Estimated efficiency, stokers.....% Pulverized coal.....%

	Pulverized coal	Stokers
18. Cost of coal for M lb steam.....	$.....	$.....
19. Auxiliary power cost per M lb steam.....	$.....	$.....
20. Maintenance cost per M lb steam.....	$.....	$.....
21. Total cost per M lb steam.....	$.....	$.....

THE OPERATING ENGINEER

George Edwards *Advisory Editor*

PRACTICAL AIDS · MAINTENANCE HINTS · QUESTIONS — ANSWERS

PUBLISHED MONTHLY AS AN INTEGRAL PART OF POWER

Prevent Costly Boiler Damage By Careful Inspection and Repair

Begin by teaching an operator what defects to look for and how to make repairs. Oliver Rantanen says many of the jobs can be learned only by systematic practice

WHEN PROPERLY INSTALLED, operated and maintained, modern boilers are dependable, safe, and give good service for many years. Improper maintenance, however, causes trouble ranging from costly repairs and shortened boiler life to explosion, with total plant destruction, and death or injury to personnel.

Because boilers are so important every maintenance man must be thoroughly trained in these duties: (1) Cool and ventilate boilers. (2) Remove, clean and replace handhole and manhole plates. (3) Clean internal and external heating surfaces. (4) Patch and renew brickwork and baffles. (5) Renew piping on any boiler part. (6) Renew tubes (and know when this is necessary). (7) Pound back tube bags (and know when this is safe). (8) Check condition of all boiler parts including drums, tubes, headers, mud drum, circulating nipples, superheater, water column, water glass, feed pipe, feed valves, blowoff valves and piping. (9) Recognize corrosion, pitting, grooving or other dangerous conditions. (10) Return boilers to service in good and safe working order.

Frequency of inspection, which varies with each plant, ranges from monthly to yearly. Ordinarily inspection every three to four months is sufficient. In one plant improperly treated feedwater made it necessary to turbine tubes, exposed to the furnace, once a month to prevent rupture. At the other extreme is the plant that has to take a boiler off the line only once a year for inspection and maintenance.

After a boiler is cut off the line it is good practice to blow soot with part of the remaining steam. For safety, close the non-return valve and open the vent line between it and main stop valve. Shut off feedwater-line valves on both sides of check valve, and hang conspicuous signs, *Men Working on Boiler*, on the main stop, feed and blowoff valves. Let air circulate through furnace until setting and boiler cool and steam pressure drops to zero; then open boiler vent. After temperature drops to about 140 F (feel drum or headers) drain the water. Open inspection and cleanout

Fig. 1—Examine tubes closely for bags, blisters and burned spots; replace unsafe ones. Make refractory repairs early and keep air leakage to a minimum

doors. Remove necessary manhole and handhole plates and wash boiler thoroughly.

While ventilating the boiler, start inspecting firebox and heating surfaces. Look for brickwork failure. Small holes can be repaired with a prepared filler; for extensive damage use a firebrick patch. Bad breaks or serious erosion call for a new wall. Inspect (1) baffles for holes which, if left unattended, reduce boiler efficiency (2) tubes for bags, blisters and burned spots, Fig. 1, and (3) rolled joints for leakage where tubes join drums and headers, Fig. 2.

Replacing Bagged Tubes

Considerable controversy exists among engineers as to when to replace a bagged tube. My experience guides me to leave a tube in service under the following conditions: (1) One or two small (1 or 2 sq in) bags which, struck with ball end of a ballpeen hammer (boiler empty), ring with the same tone as the unbagged surface and feel solid. (2) Numerous small, widely spaced bags (1 ft or more apart) that test solid with hammer. (3) Large bag (5 or 6 sq. in.) that has small deformation and tests solid with hammer. (4) Large-area bags widely spaced (18 in. or more) with small deformation that tests solid with hammer. (5) Undeformed burned spots that test solid with ballpeen hammer.

Replace tube under these conditions: (1) One or more small, badly deformed bags that, when struck with ball end of ballpeen hammer, sound dead and feel soft; this denotes exceedingly thin wall surface. (2) Large-area bag that has small deformation but appears thin to hammer test. (3) Burned spots (large or small) with or without deformation that test thin with hammer. (4) Any tube that seems a borderline case.

To pound a tube bag into place, use ball end of medium-weight ballpeen hammer and work around bag edge to force deformation into line. Each time around move in closer to deformation center until area has been covered. Check result with a straight edge, repeating process if necessary. Ten light hammer blows are better than a few heavy ones because light tapping brings deformation back smoothly without marking tube. Be careful not to force bag back into tube too far as this may form a scale trap and later a burned spot.

In replacing several tubes, save time by using a cutting torch. Carefully remove the tube ends so as not to injure the tube sheet. When expanding new tubes it is imperative that seat and tube end be absolutely clean to get metal-to-metal contact and a tight joint. Next consider how much to expand the tube. To an experienced man, resistance of the rolls, or the ridge left by the rolls, tells the story. Rolling a few tubes under an experienced man's supervision teaches more than can be learned from a book.

Next inspect the drums. Look for signs of oil, pitting, corrosion or other unusual or dangerous conditions. Remove oil by filling the boiler just below the manhole opening (manhole plate out) and pouring in 20 to 30 gal kerosene and about 40 lb soda ash. Replace manhole plate, open boiler vent, start a slow fire, and boil mixture 8 to 10 hr. Then blow down and wash out boiler until it is thoroughly clean.

Internal pitting is usually widespread, but may be localized near the feedwater inlet. Oxygen corrosion is recognizable by the black or brownish streaks surrounding the pits. Corrosion remedy is to install a deaerating feedwater heater to take care of the oxygen and CO_2. Best investment is to install reputable feedwater-treating equipment.

Check Water Column

While inspecting the drums, examine water-column connections and test for clear water passages to and from water column. Do this by inserting a water hose in top water-column connection inside drum; if pressure builds up, piping or column is plugged and must be cleaned. Disconnect piping at the pressure gage and blow through the line to make sure it is clear. Always put in a new gage glass when a boiler is out for inspection.

Inside the setting inspect the rolled joints for leakage, also the fusible plug. Look over the superheater for leakage, scale formation and burned spots. Inspect baffles and blowoff piping. Also check soot-blower orifice location in relation to tube walls.

A mixture of powdered graphite and cylinder oil in the form of a thick paste, applied to both sides of the manhole gasket, insures easy removal on the next inspection. Carefully clean the manhole plate and drum seat with a scraper to insure a tight fit.

Handhole seats are easily cleaned with a scraper. A bench made from 2x10 in. lumber is useful for cleaning handhole plates. Two men can use it, one on each end facing the other. The dirty plates piled on one side are cleaned, fitted with new gaskets and piled on the other side.

Before putting boiler back on the line, give it a hydrostatic test. This is a good time to go over the manhole plate nuts; they will be loose because the pressure has compressed the gaskets. Also check to see that handhole plates are tight.

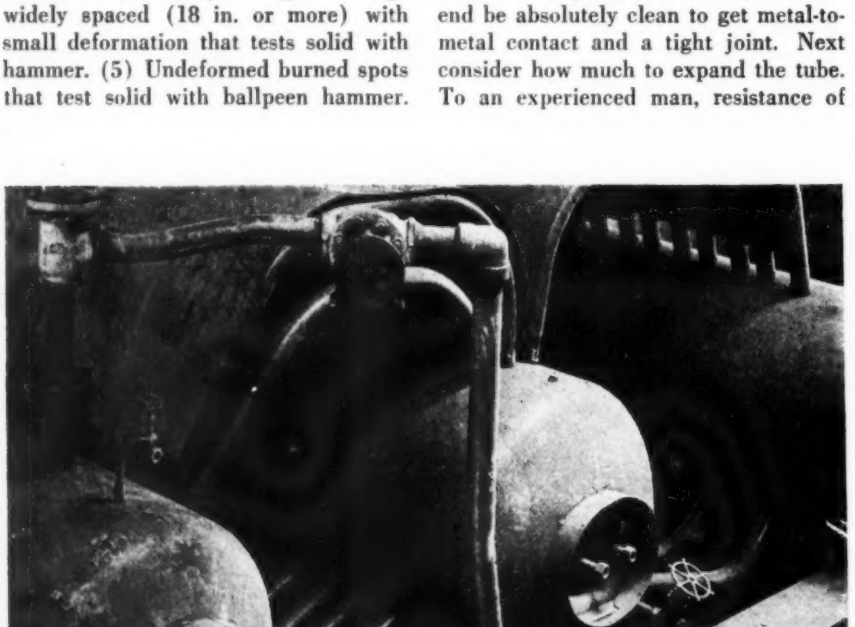


Fig. 2—Inspect tubes where they join drums and headers for leakage as sulphur gas combines with moisture to form dilute sulphuric acid, a corrosive agent

TRY PUMPING BACK
To Save the Refrigerant Charge

If receiver and condenser are large enough to hold entire refrigerant charge, pump it back before purging by hand. George Blum explains the advantage by showing how air and other noncondensible gas can be concentrated near the purge tap

ADVANTAGE OF PUMPING the refrigerant back before bleeding air from the hand-purging valve is apparent after studying the accompanying hookup and pressure-gage readings taken during the different stages of operation.

To follow the procedure assume that the liquid receiver has a volume of 20 cu ft and the condenser 30 cu ft, exclusive of tube displacement. Total amount of refrigerant in the entire system will fill 30 cu ft of the combined receiver-condenser volume with liquid at the same temperature as that of the condensing water. During normal shutdown, with 75-F water flowing through the condenser, liquid refrigerant occupies 10 cu ft, or space *D* in the receiver.

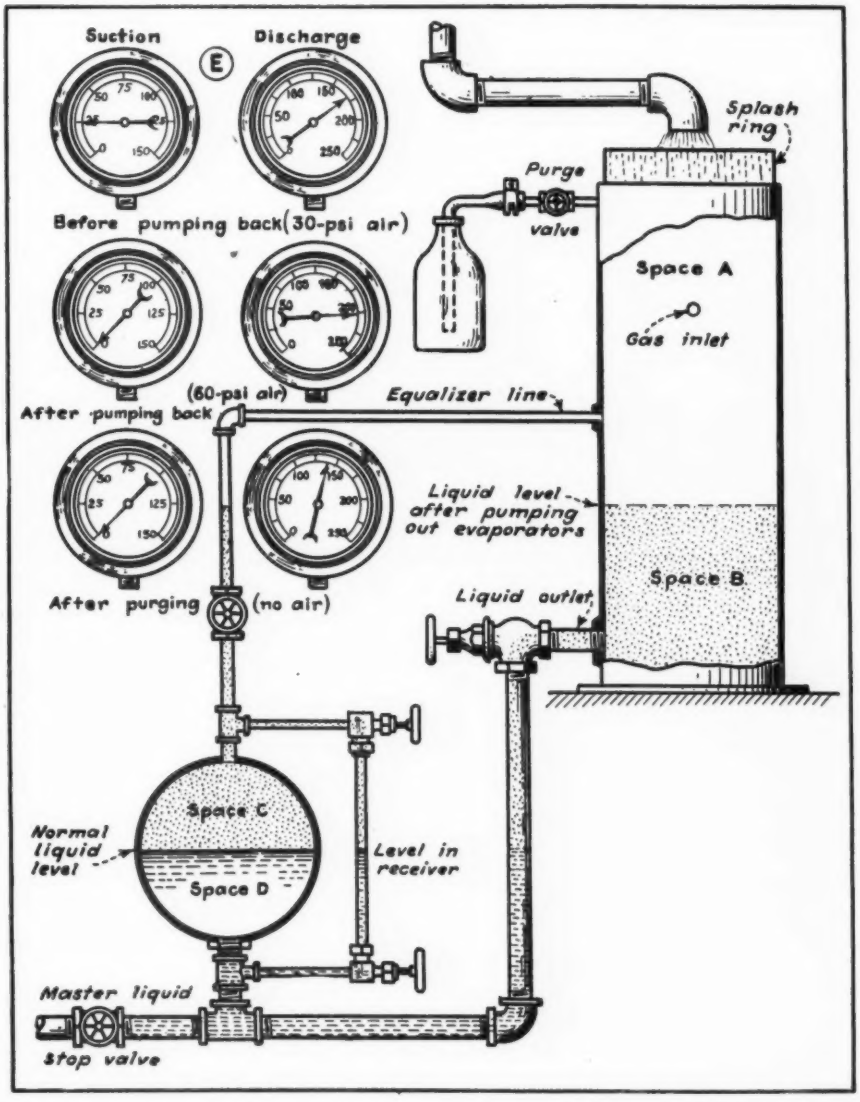
Neglecting absolute pressures, suppose that upon shutdown with 75-F water in the condenser, pressure gages read as in *E*. If the discharge gage registers 170 instead of 140 psi, it indicates that air in the system is responsible for the excess pressure of 30 psi. Under normal conditions this air is equally diffused throughout spaces *A*, *B* and *C*, being in effect 40 cu ft of air at 30-psi pressure thoroughly intermingled with 40 cu ft of ammonia gas at 140 psi. Purging the air from spaces *A*, *B* and *C* under these conditions wastes 40 cu ft of ammonia gas.

Although there is little or no air in the evaporators, the gas pumped out of them condenses and raises the liquid level in the receiver and condenser to fill spaces *C* and *B*. While the ammonia-gas pressure remains constant at 140 psi, head pressure now registers over 200 instead of 170 psi, or an increase of over 30 psi, because the volume of air-gas mixture is reduced from 40 to 20 cu ft, in space *A*.

Thus filling the spaces *B* and *C* with liquid not only reduces the total air-gas volume but also concentrates it near the purging tap. Pumping the liquid back reduces the amount of refrigerant wasted with the purged air.

Since the amount of refrigerant and the size of receiver and condenser vary in different systems this method of purging may not always be adaptable. The job then is to devise a method that fits a particular plant and removes the air with the least loss of gas.

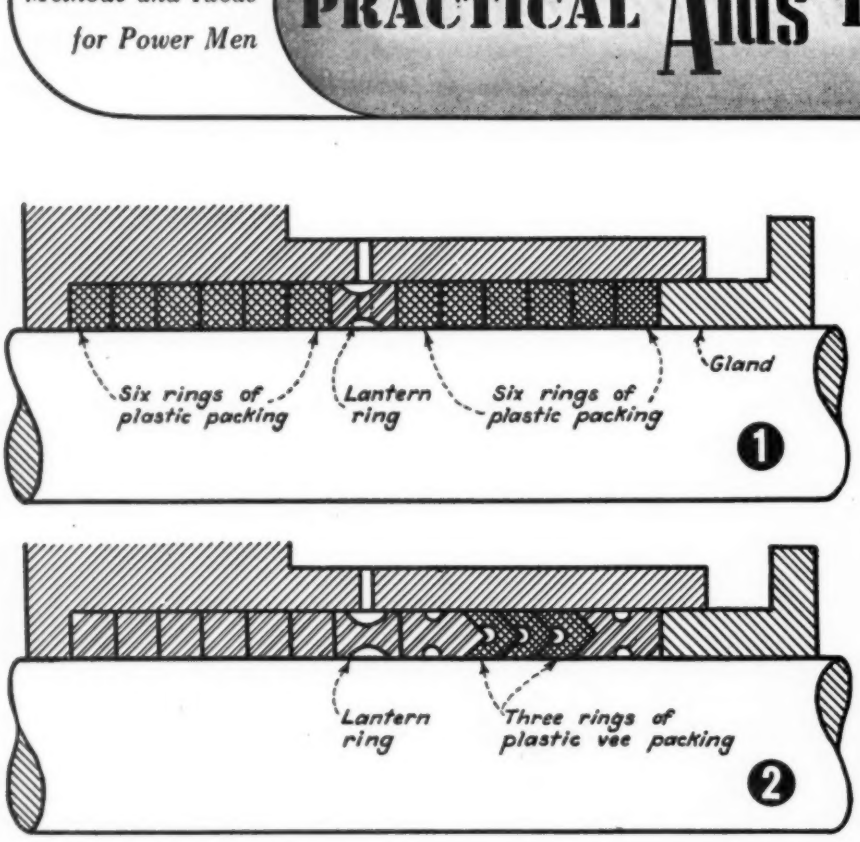
Most important problem is to keep air out of the system by either constant or periodic purging. Best results are secured with an automatic device because a slight increase in head pressure caused by air can waste considerable power and increase over-all costs in a relatively short time. Frequent hand purging keeps operating costs down.



Emptying evaporator into receiver and condenser brings entrained air nearer the purging tap and reduces air gas volume so that less refrigerant escapes

Plant-Tested Methods and Ideas for Power Men

PRACTICAL Aids to Operation



VEE PACKING RINGS REPLACE SQUARE

CRANKSHAFT PACKING of our ice-machine compressor ran hot and leaked. After a lot of experimenting with different packings I decided to try three rings of vee-shaped plastic packing. Originally the stuffing box was packed with twelve rings of ½-in. square plastic packing, six rings on each side of the lantern ring, Fig. 1. Lantern ring connected to the pressure oiling system of the compressors so that packing was well lubricated.

I replaced the six packing rings back of the lantern with six steel rings that make a loose pit in the stuffing box and on the shaft. Outside of the lantern comes a vee-seat ring for the packing, three rings of vee packing and a vee backup ring ahead of the gland, Fig. 2. All metal rings are cut in two so that they can be readily placed on or removed from the shaft.

Packing gland nuts are now made up only fingertight, but the packing holds with practically no leakage. Oil under pressure working out along the shaft and the stuffing box apparently catches the packing's vee edges to press them outward and make a good seal with stuffing box and shaft surfaces. Packing has been operating for over a year without any attention and will apparently continue for a long time before requiring renewal. We had to renew the square packing about every three months.

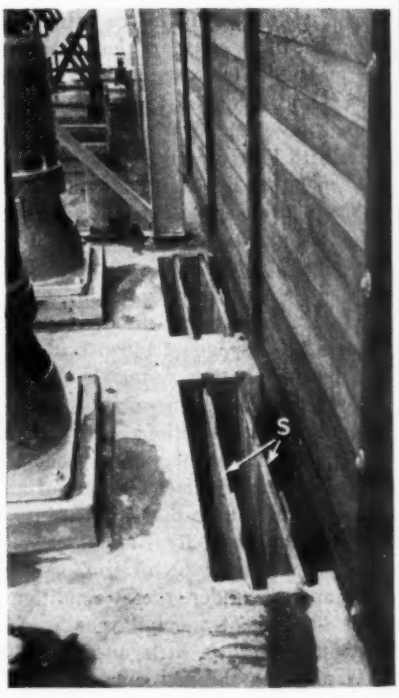
Garfield, N. J. GEORGE MORELAND
Plant engineer, Hamersley Mfg Co.

Screens Protect Cooling-Water Pumps

WATER FLOWING through an atmospheric cooling tower picked up wind-borne trash, such as sticks, paper and leaves, and carried it down into the collecting pool, from which it went with the water toward the spray-pump suctions. To prevent this material getting into the pumps, screens were set above weirs over which the water must flow to the pump suctions.

These screens are set in pairs in each pumping suction, as at *S* in the photo. The one nearer the pump has ¼-in. mesh and the outer one has ½-in. mesh. To clean, the ¼-in. mesh screen is lifted from its grooves, and the trash washed or picked from its surface and replaced before the ½-in. screen is pulled. If, as sometimes happens, pulling out the ½-in. screen releases some trash, it is intercepted by the already cleaned ¼-in. one, which may again be cleaned if necessary after the ½-in. screen is replaced. By keeping the ½-in. screen in place while the other is being cleaned, the pump suctions are always protected against material large enough to damage the impellers.

Houston, Texas CHARLES C LYNDE



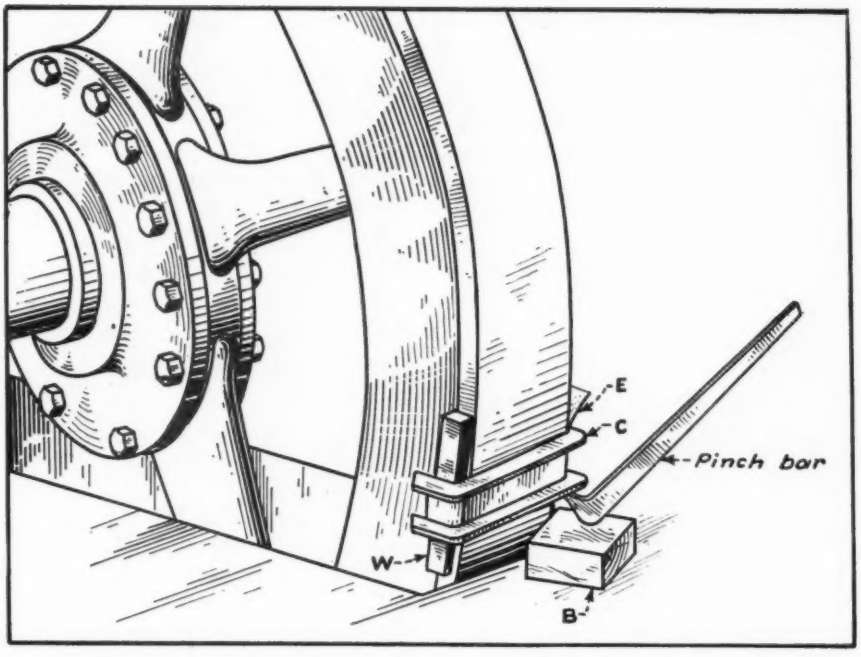
Improvised Jack Turns Steam Engine

THE 400-KW cross-compound engines in our plant did not have a jacking gear to turn them when we made repairs or adjustments. To turn them manually we looped a wire sling around one of the flywheel spokes, connected the sling to a chain block anchored overhead, and with it positioned the engine. Because space around the flywheels was limited and the main bus

passed overhead only a short distance from them, considerable juggling with the chain block was required to turn the engines.

To correct this condition I made the device in the drawing. It consists of a channel iron *C* bent to fit around the outer rim of the flywheel, with sufficient space at one end for a steel wedge. A lip on the right-hand end of the channel iron hooks around the extended rim of the flywheel to hold the iron in place. Emery-cloth strips are placed between flywheel and channel iron at *E* to increase friction between them and the iron tightened to the wheel by a steel wedge at *W*.

By using block *B* as a raised fulcrum on the engine-room floor, the flywheel can be turned with a pinch bar under the hooked end of the channel iron. Downward pressure on the free end of the pinch bar causes the channel iron to grip the flywheel until it moves. Raising the free end of the bar permits the channel iron to drop on the rim as far as the pinch-bar toe for another lift. This operation is repeated as often as necessary to position the engine for making repairs or adjustments.



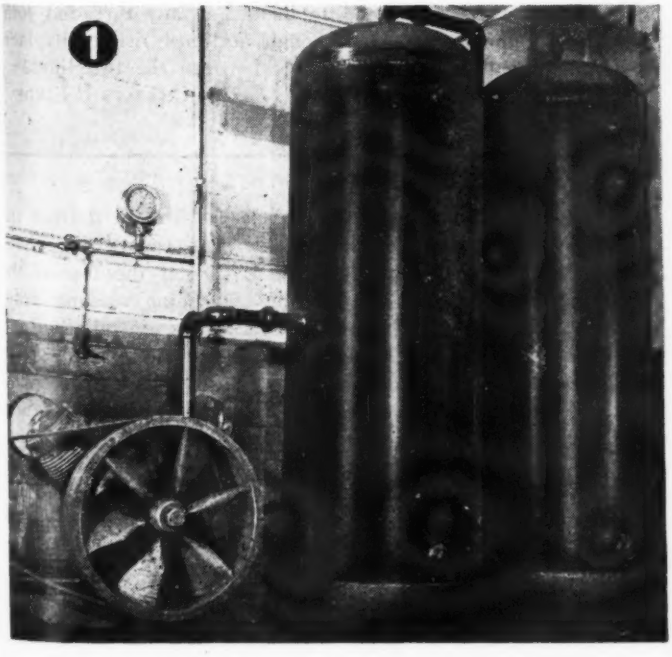
Ramsey, N. J. R W RIORDAN

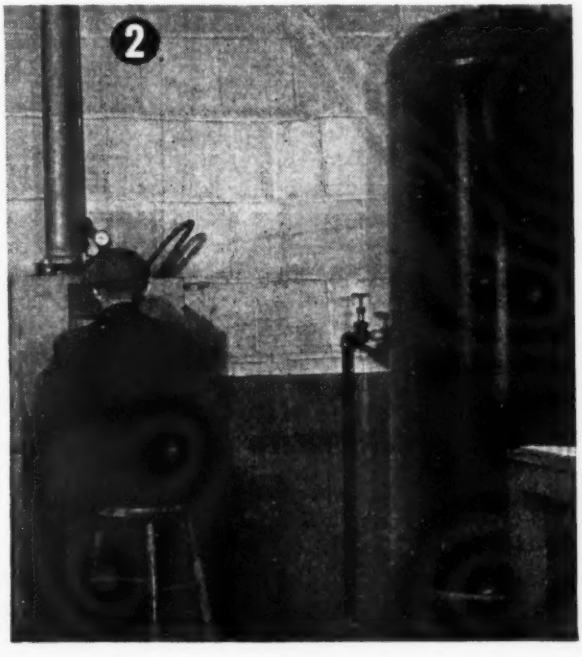
LITTLE AIR COMPRESSOR DOES BIG AIR-SUPPLY JOB

ENGINEER A R JACOBUS of Fisher Cadillac Corp, Newark, N. J., has tripled his plant's compressed-air supply without increasing compressor size or speed. At the beginning of the war this company started manufacturing cemented-carbide and high-speed-steel-tipped cutting tools used on boring mills, lathes, automatic-screw and similar metal-working machines. Intermittently, about 250 cfm of compressed air is required in making this product. Sandblasting also required an equal amount in addition to that needed in air guns for many cleaning jobs.

To supply this air a 45-cfm compressor V-belt driven by a 10-hp motor was available. This compressor originally supplied air to a large automobile service shop. The large demands for air for tool manufacturing on the third floor of the building threatened to interfere seriously with the automobile service operations on the ground floor. Something had to be done to insure an ample supply for both floors.

A survey showed that all air demands were intermittent and that if ample air-storage capacity were installed the compressor could do the job. Accordingly the small receiver



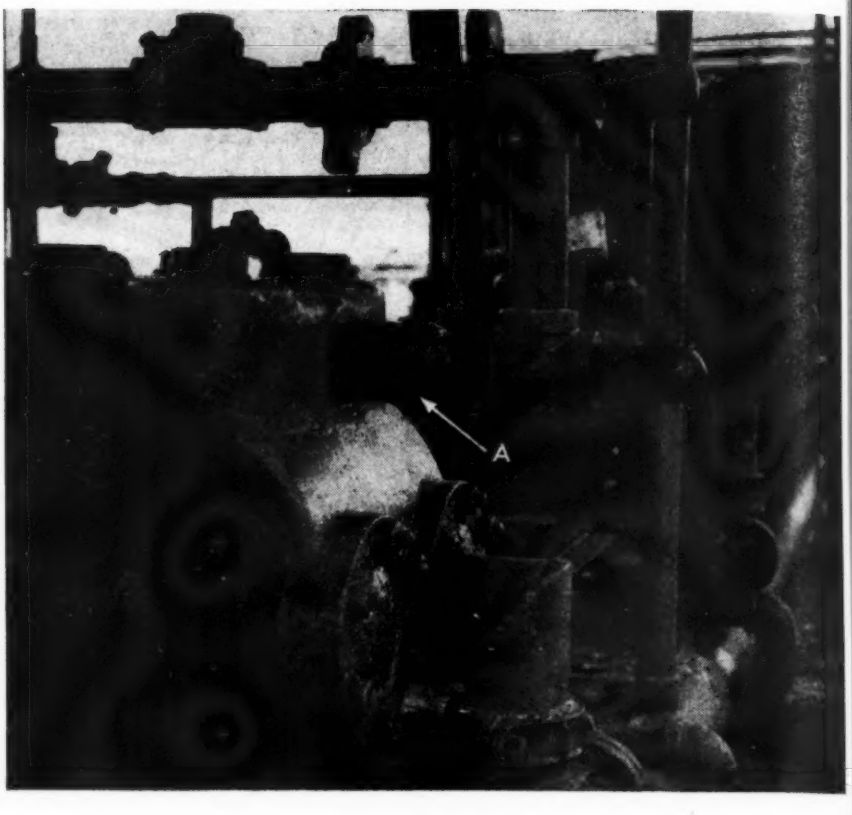


on the compressor was replaced by three 30x96-in. ones. Two of these were connected in series and installed at the compressor in the basement, Fig. 1, and the third one was placed on the third floor about 75 ft from the compressor, Fig. 2. All air used on this floor passed through this receiver. As further insurance of dry air a water leg made of a piece of 3-in. pipe 2-ft long was installed at the low point on the 1-in. air line leading to the service shop and tool manufacturing floor.

The receivers have eliminated all difficulties because of insufficient air, even when stepped-up manufacturing schedules double original air requirements. Aftercooling effects of the receivers in series insure clean, dry, oil-free air to all air-using devices even on humid days.

Cost of the three receivers was less than that for a larger compressor. Power bills have increased, but not so much as for a larger compressor and motor. In the new system the big receivers dwarf the compressor, but the system works and delivers three times as much air as it was originally designed for. If your compressed-air supply is unsatisfactory what Mr Jacobus did may be the answer to your problem.

East Orange, N. J. RUSSELL GROSS



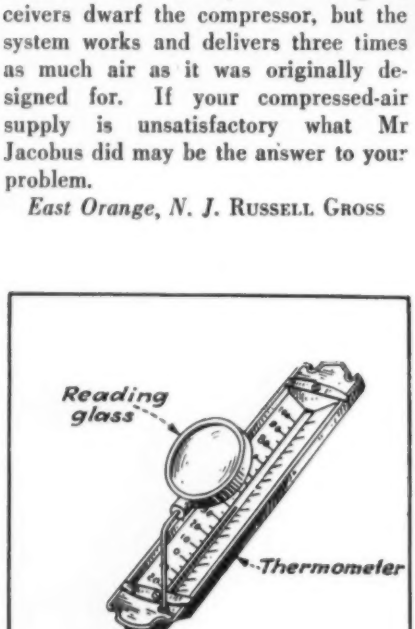
THREADED JOINTS EASE PUMP STRESSES

ON BOILER-FEED PUMPS of an outdoor steam plant, discharge pipe from each pump came out horizontally, as at *A* in photo, and made a 180-deg reverse bend back over the pump. Because the pumps were on poor foundations they vibrated and put both torsional and bending stresses on the threaded discharge connection in the pumps. These stresses caused a movement in this connection that made the threads wear and leak.

To overcome this difficulty the engineer replaced the 180-deg bend with one made of fittings, as in photo. Hookup uses a pair of tees connected by a short nipple, with their unused ends blanked off with bull plugs. This assembly permitted a slight shift out of parallel between the two horizontal lines and rotation around the threads in the fitting to absorb the vibration stresses without transmitting them to the threaded connection in the pumps.

Made up with a good joint compound when assembled, these return bends have not leaked at any threaded joint even though at times visible displacement exists between the two lines.

Houston, Texas CHARLES C LINDE



Magnifying Glass Helps Us Read Thermometer

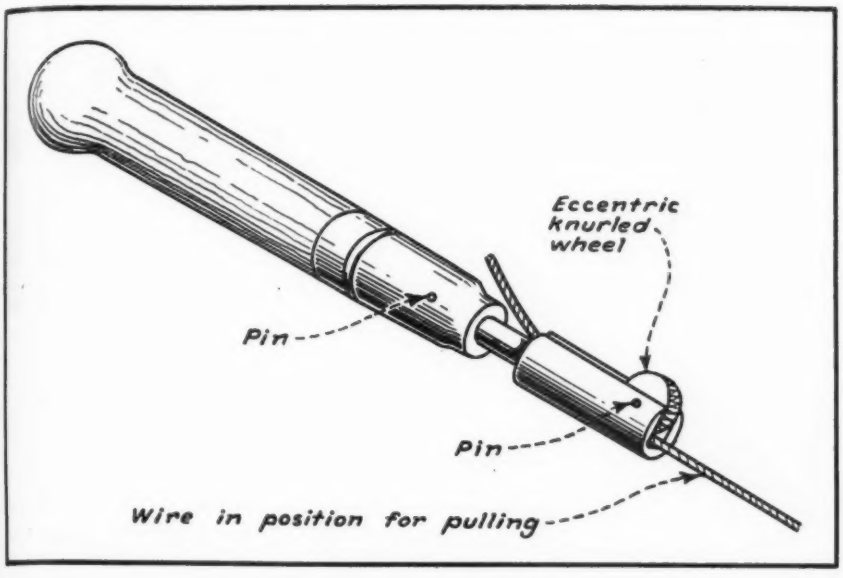
A CLOSE-READING THERMOMETER may be difficult to read accurately, particularly if the lighting is not good. On such a thermometer we installed a small, low-priced reading glass. We supported the glass from the thermometer frame in a position to cover the normal temperature range and to focus for most convenient reading. This arrangement permits us to read the thermometer accurately and quickly.

London, O. F W SCHNEIDER

Extra Length Increases Skip-Hoist-Cable Life

IN OUR POWER PLANT we handle coal and ashes with a skip hoist. Increased service because of war loads greatly reduced skip-hoist-cable life. We discovered that heaviest wear on the cable occurred along the first 15 ft from the bucket. This was caused by shock loads when it was at the top of the run. The hoist-machine winding drum was extra long for our installation and had nine vacant grooves.

After considering these two conditions together we decided to buy new cable 60 ft too long for the job and wind the excess in the vacant grooves on the drum. Now when the cable end next to the bucket needs replacing we cut it off, and unwind some of the extra cable off the drum to replace the defective section removed. Thus we get eight months' service from a cable



WIRE PULLER HAS SLIP-PROOF GRIP

AN EASILY CONSTRUCTED wire puller, devised by Carl Schreck at GE's Schenectady works regulator division, has improved the method of tightening locking wires. Handling the puller is easier and much safer than the conventional method of tightening wire with pliers.

A knurled, eccentric wheel ⅛ in. thick and ½ in. in diameter is the secret of this device's advantage. It is mounted in a piece of drill-rod with a milled slot to accommodate both wire and wheel, as in the diagram. The wire is threaded into the slot and under the wheel, which is then rolled back toward the handle to apply pressure on the wire. The grip is automatically increased as the operator pulls the tool to tighten the wire.

Drill-rod is about 2½ in. long of ½-in. stock. The shank end, however, is turned to a ¼ in. diameter and is fitted and pinned in a wooden handle. The pin, knurled wheel and rod should all be hardened.

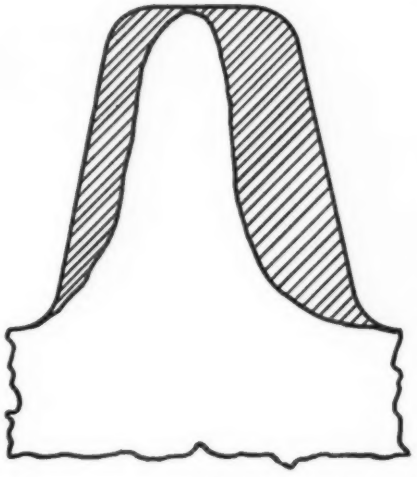
whereas before we had to replace it about every two months. This change saves both material and labor and reduces hoist out-of-service time.

Detroit, Mich. RICHARD BROWN

Bronze Welding Puts New Life In Cast-Iron Gears

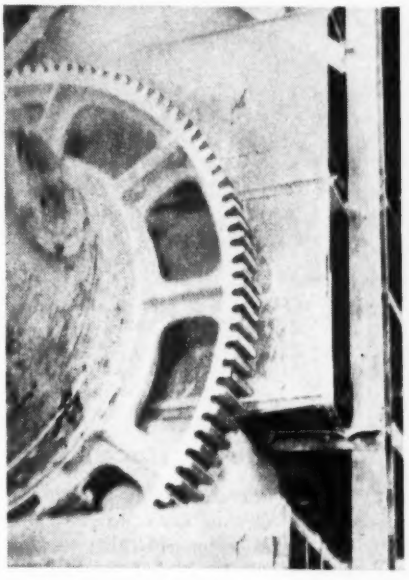
A REFRACTORIES-MANUFACTURING company faced an 8-week shutdown of a tube mill when its gear was damaged beyond repair. Fortunately an old, badly worn gear removed from the mill some time previously was still on the scrap pile. When new, teeth in this gear were 2 in. thick at the base and tapered to 1¼ in. at the top. But they had worn to a thickness of about 1¼ in. at the base and ¼ in. at the top, and six teeth had broken off.

It was decided that this old gear could be put in condition by bronze welding to last until a new one could be obtained. After four days' work the old gear was ready for service. Welding which required 235 lb of bronze welding rod, was done without preheating the gear. Labor, materials and installation cost less than half that for a new gear. The cross-hatched area in the diagram indicates how much each tooth was built up with bronze, and the photo shows the gear after welding was completed.



When the old gear was being reclaimed a new cast-iron one was ordered, because the reclaimed one was not expected to last very long. However, after more than ten years' service it is still going strong as a recent inspection showed. At the present rate of wear it should give five years' more service.

Before the gear teeth were bronze surfaced, it was necessary to install a new cast-iron gear about every two years. In about one year the teeth would wear



badly on one side, and the gear would be reversed for another year's service from the other side of the teeth, then it would be discarded. Thus, the bronze-faced gear has already outworn five cast-iron gears.

New York, N. Y. H H GRIFFITH
The Linde Air Products Co

You've Got to Love 'Em

DISCOURAGED by his apparent inability to raise flowers, a man asked his more successful neighbor how he managed such a garden.

"Man, you got to love 'em to make them grow," replied his friend.

There is a lot of truth in that statement in other crafts as well as in gardening. To be a good mechanic you must really like machinery. You must not merely enjoy working around it but feel a genuine affection for it. It actually hurts a real mechanic to see machinery neglected or abused whether it is under his care or not.

The same is true about our jobs; we've got to love 'em if we want them to grow.

Troy, N. Y. GILBERT LINDGREN

READER'S PROBLEMS

Exercise your engineering wits by submitting answers to these questions fresh from the plant. Suitable material will be paid for; answers accompanied by sketches or photographs command additional pay

Questions from Our Readers

1—What Causes This Engine to Race?

WE HAVE a uniflow engine direct connected to a 500-amp 250-v dc generator, which is giving us considerable trouble.

When starting up and running without load, the engine races. If we open the cylinder drain valves, it comes back to normal speed. The same conditions prevail when load is removed in preparation for shutting down; cylinder drains must be opened to hold engine speed at normal. Engine governor has just recently been overhauled and, as far as we can determine, is in good operating condition.

Any suggestions from POWER readers as to the cause of this trouble and its cure will be deeply appreciated.—AF

2—Which Starting Method Is the Best?

WE RECENTLY changed our factory over to purchased power and disposed of all generating equipment except one salient-pole (without amortisseur winding) ac generator, with its direct-connected exciter and switch panel. Generator voltage is the same as the incoming power (2300 v).

Plans are being made to use this generator as a synchronous condenser to correct plant power factor. But to date we have not decided on the method of starting and paralleling it with the system.

Which is the better arrangement, a starting transformer to bring the unit to speed as an induction motor or a motor drive to accelerate it for paralleling as a generator? Also what changes must we make in the voltage regulator to adapt it for condenser operation? List other precautions.—*CLF*

Answers to February Questions

Must Air Vents Be Removed from Radiators?

(This is Question 1 from the February issue, with best answers from readers.)

OUR STORE BUILDING *was originally heated by a 1-pipe steam system. Recently an outside contractor installed a 2-pipe system with vacuum return. In one area he left the air vents on several radiators and connected their returns to a common trap. As now installed we do not have heat on the upper floors and the return pump holds only a 2-in. vacuum.*

Could we correct this trouble by removing the air vents and fitting each radiator with an individual trap? What other faults should we look for when changing from a 1-pipe to a 2-pipe system.—EJ

Suggests Water Spray

IN A 2-PIPE vacuum-heating system it is usual practice to install a trap on each radiator. Feeding cold water to the vacuum pump condenses any vapor that gets into the return line, thus increasing the vacuum. Leaks in return line or open air vents affect the vacuum.

Important difference between a vacuum-heating system and others is that a vacuum is constantly maintained in the returns. This permits the system to operate with steam of any convenient pressure and from any source, either exhaust or boiler pressure. Pressure and temperature throughout the entire system may be adjusted and maintained at any degree to suit all kinds of weather and service.

This system also permits (1) using steam that is just warm enough to operate traps or thermostatic valves placed on each radiator and (2) return to discharge accumulations of water and air.

Thorold, Ont. G BARRETT

Drain All Low Points

I SUGGEST that all air vents be removed and vent holes in radiators plugged. Each radiator should have a trap connected to the common return going to the vacuum pump. Steam main should have a thermostatic-float bleeder trap at all low points. Entire system should be air tight.

I assume that the pump is a combination vacuum and boiler-feed; if not, install a vented receiver tank between the two pumps.

Winona, Minn. T MUELLERLEILE

Inspect Vacuum Pump

I SUGGEST that EJ remove all air vents and fit each radiator with an individual trap. To guarantee proper circulation of heat to the upper floors, extend the steam line to a point above the highest radiator and on the extreme end of this fit an air vent.

I also suggest, not knowing the building height, that a small priming line (¼ in.) be run from the main steam header in the basement to the highest radiator. Open the feed valve on this line during initial warm-up periods only.

If it is difficult to maintain a high vac-

uum, check the pump thoroughly for defects or gland leaks. There may have been enough sediment left in the new system so that the new pump is unable to maintain a good vacuum.

Kearny, N. J. GEORGE MCNALLY

Use Individual Traps

SKETCH 1-B shows a one-pipe up-feed steam-heating system with air vents on all radiators and manual valves on steam risers. Runouts to risers are taken off the top and pitched back to the steam main, which slopes in direction of steam flow and connects to a wet return (below boiler water line) beyond the last runout riser. Return then runs along the floor back to the boiler and is connected to the equalizer or steam-header drip at a point 2 in. below the boiler water line to form a *Hartford loop*.

The Hartford loop prevents water being forced out of the boiler and into the return line when excessive steam pressure is generated in the boiler. It also precludes damage from overheating by preventing the boiler losing water should a leak occur in the wet return.

Sketch 1-C shows a typical up-feed vacuum steam-heating system. Boiler hookup and steam supply lines are identical with those of a one-pipe steam system. Air vents are omitted on all radiators.

Vacuum system is a 2-pipe one employing a thermostatic trap on the return of each radiator and a vacuum pump on the main return. Thermostatic trap freely drains air and condensate, but prevents steam escape to the return line. Vacuum pump discharges air from the system and pumps the condensate back to the boiler or receiver tank.

Modern vacuum pumps are usually of the rotary type with the water impeller and air rotor on one shaft directly connected through a flexible coupling with the motor. The air-liberating tank, strainer, vacuum breaker and vacuum controller are all an integral part of the pump. Usually these pumps are fitted with a dual automatic control arranged so that the pump is started or stopped by either water level in the receiver tank or vacuum carried on the system independently. A connection must never be made from the supply to the return side except through a thermostatic trap, and then only to the main return on the pump inlet.

Slope all returns downward toward the vacuum pump thereby insuring uninterrupted condensate flow. When this is not possible drop the return below the vacuum pump inlet before the pump is reached. In such a setup provide a lift fitting in the return line at pump intake. An accumulator tank with float control may be used in place of the lift fitting.

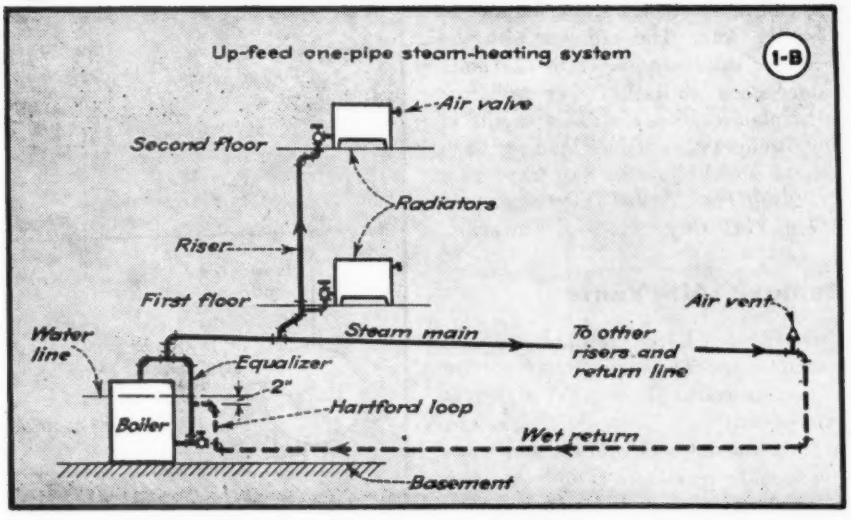
Where risers are drained through a thermostatic trap they may be connected to the bottom of the steam main thereby serving as a drain for the main also. Steam main or mains should terminate in a drip connection through a thermostatic trap connected to the main return line.

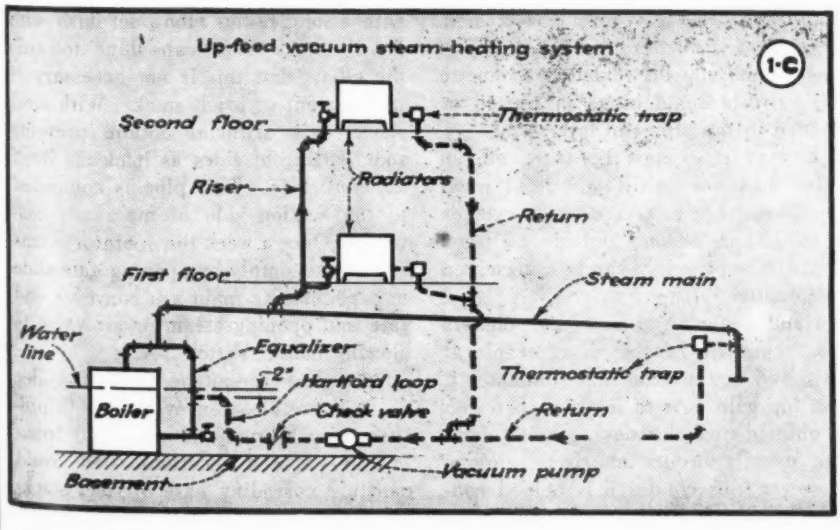
Changes necessary to convert a one-pipe up-feed system to a vacuum-pump system are: (1) Remove air vents from radiators and close openings with plugs. (2) Existing steam supply line and, risers, if installed according to sketch 1-B need not be disturbed, but check carefully to see that all lines slope properly to prevent pocketing air or water. (3) Install return riser and main, connect all radiators, riser and steam main drains through thermostatic traps to main return line. (4) Install vacuum pump in main return, sketch 1-C. See that all joints are air tight.

More than one radiator may be connected to a common thermostatic trap only if the heating load on each radiator is the same. In practice this is rarely true, since many factors enter into consideration to vary the loading. Location of each radiator has a marked effect on condensation rate.

Let us see what takes place when several radiators are served by a single thermostatic trap. All returns on the upstream side tie into a common line just ahead of the trap. Thus a common clear path is provided between all radiator returns so connected. If one radiator condenses steam at a greater rate than any other, the relatively cool condensate will open the thermostatic trap and pass through. However, the other radiators not condensing under the same conditions are filled with steam that attempts to leave with condensate from the first radiator.

Two effects are felt: (1) There is a loss of steam. (2) Resulting high-temperature mixture of steam and conden-





sate causes the thermostatic bellows to close the trap. The radiator with the greatest condensation rate becomes water-logged until the other radiators accumulate condensate. This results in sluggish operation and air binding. Each radiator should have its own trap.

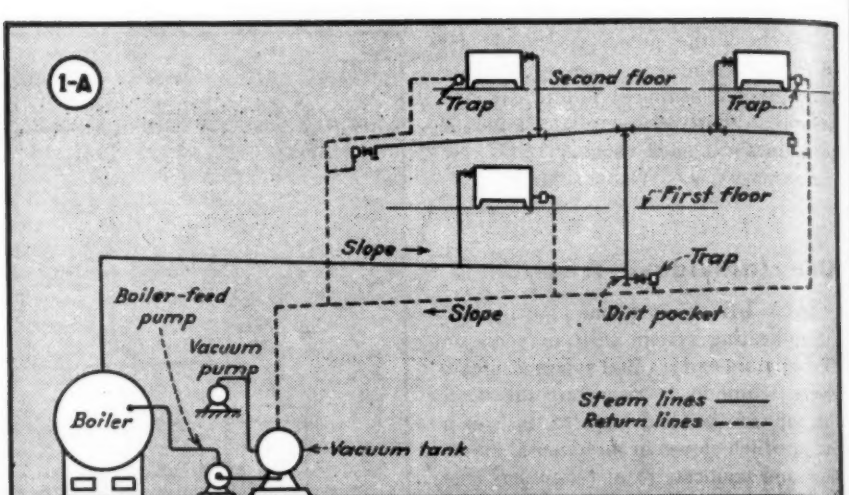
Cliffside Park, N. J. J D CONSTANCE
New York City L FOWLER

Remove Air Vents

I SUGGEST that EJ fit each radiator with a steam trap. The air relief valves are no longer needed. It does not seem reasonable that only 2 in. of vacuum can be maintained. Check over the entire system to make sure there is no connection between steam main and return at any point except through a steam trap. Horizontal mains should slope in the direction of steam flow with a trap installed at the far end to return accumulated condensate, sketch 1-A. Vertical risers should be equipped with dirt pockets and drip traps at the bottom.

If these precautions have been taken and the vacuum pump is of correct size and operating properly, failure to maintain sufficient vacuum is caused by air or steam entering the return through a leak or defective steam trap. This trouble must be corrected.

Elmira, N. Y. M H ELKIN



Test the System Under Pressure

A TRAP on a steam-heating system is a ball float, bucket, or thermally operated device that removes condensate from piping or radiators in which there is one pressure, and delivers it to drain or hotwell at a lower pressure. Dual-pressure traps deliver condensate to higher pressures than that in the system they serve. But these must be operated by still higher pressures. Or, mechanical traps, generally called vacuum pumps, are used to lift condensate against a higher pressure than that in the system.

I mention this distinction between a trap and a vacuum pump because EJ states that the contractor installed a 2-pipe system with vacuum return. Then he adds that "In one area he left air vents on several radiators and connected their returns to a common trap." I determine from this that the one area

(*Continued on page* 136)

What Is the Best Way to Clean Chimneys?

(This is Question 2 from the February issue, with best answers from readers.)

I WOULD LIKE TO KNOW *how other engineers remove soot and cinders from chimney bases. What methods can be used and what are the limitations of each? What special precautions must be observed during removal by hand to do the work safely?*

I have both metal and brick chimneys and I am particularly concerned about possible corrosion in the former. Another inconvenience is loss of draft when opening them for hand cleaning. Future plans call for some method other than hand removal and I would like to know the advantages or disadvantages of each method.—DAL

Use Flap Valve

SOOT AND CINDERS can be moved from a stack through a pipe installed in center of base and run outside to terminate in a flap valve. Weight of ashes opens the flap periodically. Material can then be carried away by any method best suited to local conditions. While this arrangement will not remove all material from stack base, it does prevent building up to a height that chokes the draft and interferes with proper chimney operation.

Pipe is installed on an angle of any pitch that allows the material to flow into the pipe. Flapper valve is made of ⅛-in. sheet steel or, if desired, of stainless steel to prevent corrosion. Lever arm is made of ⅛x1-in. flat iron or steel and may be welded or riveted to the valve. Monel hinge is riveted or welded to the pipe and lever arm.

End of pipe must be faced off, so valve makes a good, tight joint when it closes. Lever arm usually extends 8 to 10 in. beyond outside of pipe. Proper size of weight can be determined by practice.

Hand removal of soot and cinders from chimney base is disagreeable at best, and any method that eliminates it is a big help. As to internal corrosion of unlined steel chimneys, greatest damage usually occurs at riveted joints. However, this condition is helped considerably when erecting a new stack by welding these joints; sometimes old stacks have been welded.

Scranton, Pa. E E SMITH

Keep Stacks Painted

WE SOLVED our ash-removal problem by excavating a trench in the stack base and running a 6-in. extra heavy pipe to the center of stack base, terminating with a long radius elbow set flush with floor. Stack floor can slope towards the elbow, but this is not necessary if it is cement or brick stack. With steel stacks this artificial bottom prevents soot settling at sides as it cleans itself automatically. This pipe is connected to the suction side of main ash conveyor. Once a week the operator cleans stack base simply by opening gate slide in pipe, closing main ash conveyor end gate and opening steam or air valve to blowing nozzle, sketch 2-A.

Steam lines are pitched towards boiler room as are also conveyor pipes to prevent them filling with water and freezing in exposed locations. To avoid moisture corroding base of steel stacks

they should always be placed on a footing 3 ft or more above ground that slopes toward the edge to act as a drain. Interior and exterior of stack should be chipped free of scale, wire brushed and given a couple of coats of red lead and tar paint. As a rule flyash is always dry in an active chimney and corrosion is greater in a dead stack. Here the best remedy is to keep the base free of soot after boiler is shut down to prevent it absorbing moisture and forming a corrosive acid.

Ottawa, Ont. JOSEPH BONGIORNO

Install Pneumatic System

FOR THE PRESENT, best solution is to remove soot and cinders from the chimney bases by wheelbarrow. DAL should select a day when boiler load is lightest so that draft loss does not greatly affect boiler efficiency. He should open the cleanout doors, wet down the contents of the chimney base and pull it out to a spot nearby until all bases are cleaned.

To prevent corrosion in the metal stack, treat interior and exterior with a corrosion preventive.

Later, DAL can install a pneumatic ash-exhauster system. With a soot collector in the breeching and a pipeline run from the stacks, he can remove cinders and soot automatically without opening the cleanout doors.

Newark, N. J. R C CONK

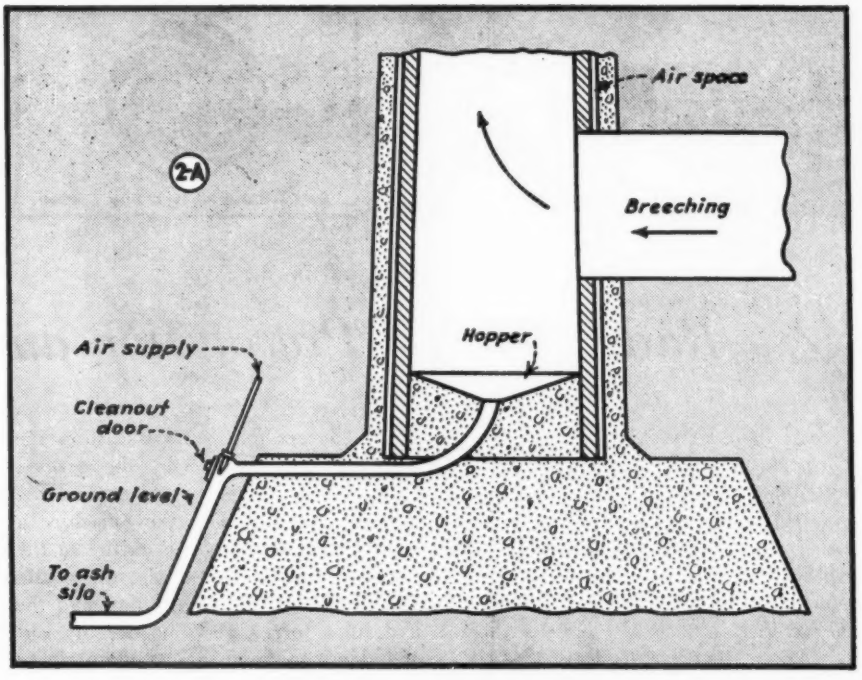
Use Steam Exhauster

A SIMPLE WAY to remove ashes with minimum equipment is to attach a section of 2-in. pipe to a length of water hose and insert it through the cleanout opening at chimney base. Cleanout door can be replaced during soot removal with a wooden cover that has an opening at its lower edge large enough for the pipe and the mingled stream of water and soot discharge.

While this method requires minimum equipment, it has these definite disadvantages: (1) Wet soot must be shoveled into wheelbarrows and carted away. (2) Several men are required if the job is done properly. (3) This removal method is practical only with brick chimneys.

A vacuum system can also remove soot. Steam is used to create the vacuum. This removal method is simple and usually requires only one man.

Sections of heavy flanged piping, usually cast iron, are so arranged that the open end is near the chimney cleanout door; the other end (discharge) leads to the ash bunker or silo. Immediately ahead of the bunker a venturi-shaped length of pipe is inserted into the system with a hollow steel ring just below it.

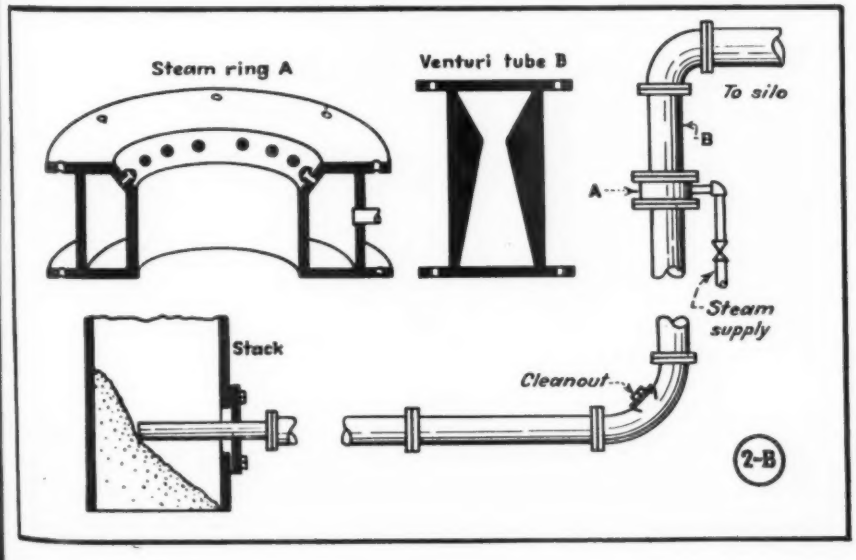


This ring, sketch 2-B, has a steam connection on the outside diameter. Inside diameter is so constructed that the upper inside surface has an angle of about 45 deg. Into this surface are fastened the steam nozzles, pointing toward the venturi tube. The piping is generally 6 to 8 in. in diameter, except the length that is inserted in the stack. Its diameter is 4 in.

To operate, the 4-in. pipe is connected to the open end of the large line and inserted into the soot at the chimney base. The valve on the steam line leading to the hollow steel ring is opened and the system is then ready to remove soot. The operator, provided with a long steel-handled hoe, simply pulls the soot and small clinkers toward the open end of the pipe. Elbows between the horizontal and vertical parts of the system have cleanout doors.

The silo or ash bunker must be provided with a dust separator and vent so that pressure cannot build up. All points of wear, such as outside bend of elbows, are so made that just this part can be replaced when it becomes worn. The system can also be arranged to pass under the furnaces to remove ashes from the pits. Disadvantage of this system is the large amount of steam used.

Buffalo, N. Y. J B THUMAN



CENTRIFUGAL PUMP Q AND A FOR POWER ENGINEERS

By I J Karassik and Roy Carter

2—*Radial Thrust, Prerotation and Wearing Rings*

Second in a monthly series by Igor J Karassik and Roy Carter, Worthington application engineers. These two experts on centrifugal pumps have selected questions and answers that give a broad, practical understanding of the pumps, their construction, operation, characteristics, troubles and remedies.

Q 1—*What is radial thrust?*

A—In a single-volute centrifugal pump, Fig. 1, fluid discharged by the impeller into the volute produces hydraulic forces that act radially on the impeller, as indicated by the arrows. These forces are not equal around the impeller, consequently they produce a radial thrust that is transmitted to the shaft. At reduced capacities the volute area is not correct for the flow and the hydraulic forces get considerably out of balance to produce a resultant force that acts radially on the shaft.

Q 2—*What is a twin volute?*

A—A single volute, Fig. 1, completely surrounds the impeller. A twin volute, Fig. 2, is in effect two half-capacity volutes each taking the discharge from 180 deg of the impeller in a way that approximately balances the radial thrust. It is sometimes used in single-stage pumps, particularly those of large capacity for high heads, and in multi-stage developing high heads per stage.

Q 3—*What is a twin-volute diffuser?*

A—It is in effect a twin volute, but cast separately from the casing. It resembles a diffuser with but two vanes, Fig. 3 and 4, and is used mainly on

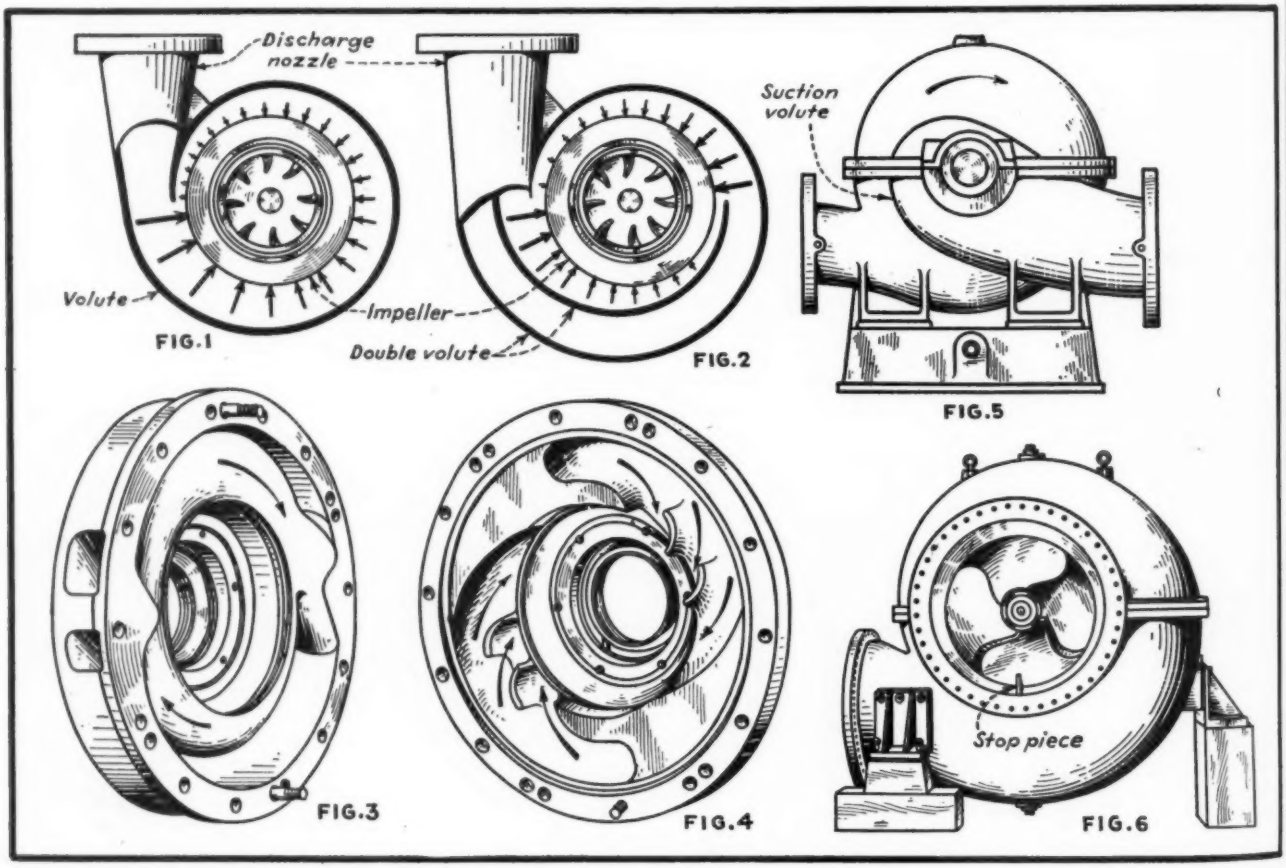


Fig. 1—In a single-volute pump unbalanced hydraulic forces put a radial thrust on the impeller shaft. Fig. 2—A double-volute casing balances the radial hydraulic forces acting on the impeller. Fig. 3 and 4—Twin-volute diffusers used mainly on multi-stage pumps when the diffuser also contains the return channel to the following stage. Fig. 5—A projecting section in the suction volute of single and multi-stage pumps helps direct flow into the impeller. Fig. 6—Stop-piece projecting in from suction-nozzle wall is commonly used to prevent prerotation of the fluid

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PUMP Q AND A

(*Continued from page* 114)

multi-stage pumps, where the diffuser also contains the return channel to the stage that follows.

Q 4—*What is prerotation?*

A—When a column of liquid in the suction pipe and pump-suction passages approaches a rotating impeller, its rotation can cause the liquid to spiral back in the suction pipe some distance from the impeller. This phenomenon is called prerotation. It results from several causes, such as improper entrance conditions and shape of approach, and can decrease the net effective suction head and pump efficiency. Various means are used either in the pump's construction or in the pump-approach design to avoid this phenomenon. There are cases, however, where the effects of prerotation have been used in special applications to produce desired effects in pump performance.

Q 5—*What is a stop-piece?*

A—It is a projecting section in the suction volute, Fig. 5, of single-stage and multi-stage pumps to help direct fluid flow into the impeller eye. In end-suction pumps, improper entrance conditions may cause prerotation. To prevent this, a radial fin (stop-piece) projecting in toward the center from the suction-nozzle wall, Fig. 6, is commonly used.

Q 6—*Why do some end-suction single-stage pumps with solid casings have casing suction heads, Fig. 7, for impeller removal, others have stuffing box heads, Fig. 8, and still others have both a casing suction head and a stuffing-box head, Fig. 9?*

A—For end-suction pumps up to 4- and 5-in. discharge and for the cheaper "contractor" designs, the volute and one side can be cast in one piece. Choice of whether the stuffing-box side or suction side is cast with the casing usually depends on the pump's general design with the aim to obtain the lowest cost. For some larger designs like those for sewage, there is a demand for pumps of both rotations. A design with separate suction and stuffing-box heads, Fig. 9, permits using the same casing for either rotation if both flanges are identical. Vertical shaft pumps can best be dismantled by removing the rotor and bearing assembly from the casing top. Likewise, in many horizontal applications the installation favors partial dismantling from the suction side.

Q 7—*What is a side plate?*

A—It is a stationary part mounted within the casing, Fig. 10, used to provide a close-clearance guide to the water flowing through an open impeller.

Q 8—*Why are wearing rings used?*

A—To avoid wearing the adjacent surfaces of pump casing and impeller, separated by a running clearance *C*, Fig. 11, removable rings are used in this joint. Wear in the joint occurs on these rings, which can be replaced at a small part of the cost of a new impeller or casing.

Q 9—*What is a casing wearing ring?*

A—Sometimes called impeller-guide ring, a casing wearing ring is inserted in the pump casing, Fig. 12 and 13, to protect the latter from wear.

Q 10—*What is an impeller wearing ring?*

A—To protect the impeller from wear at its running joint within the casing or casing ring, it is fitted with a removable ring called an impeller wearing ring.

Q 11—*What is a flat wearing ring?*

A—It is a design in which the leakage joint is a straight annular clearance, Fig. 12 and 16. This type of ring has been replaced extensively by L-shaped and labyrinth designs.

Q 12—*What are double wearing rings?*

A—They are renewable rings on the

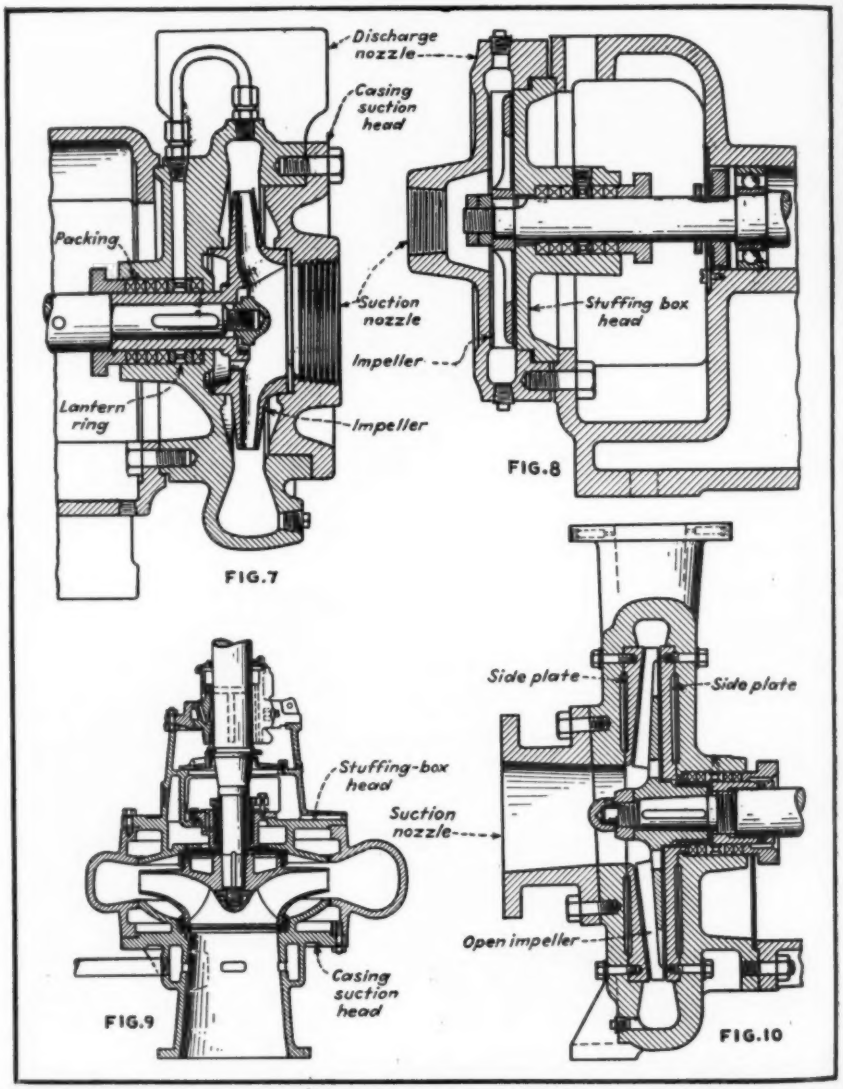
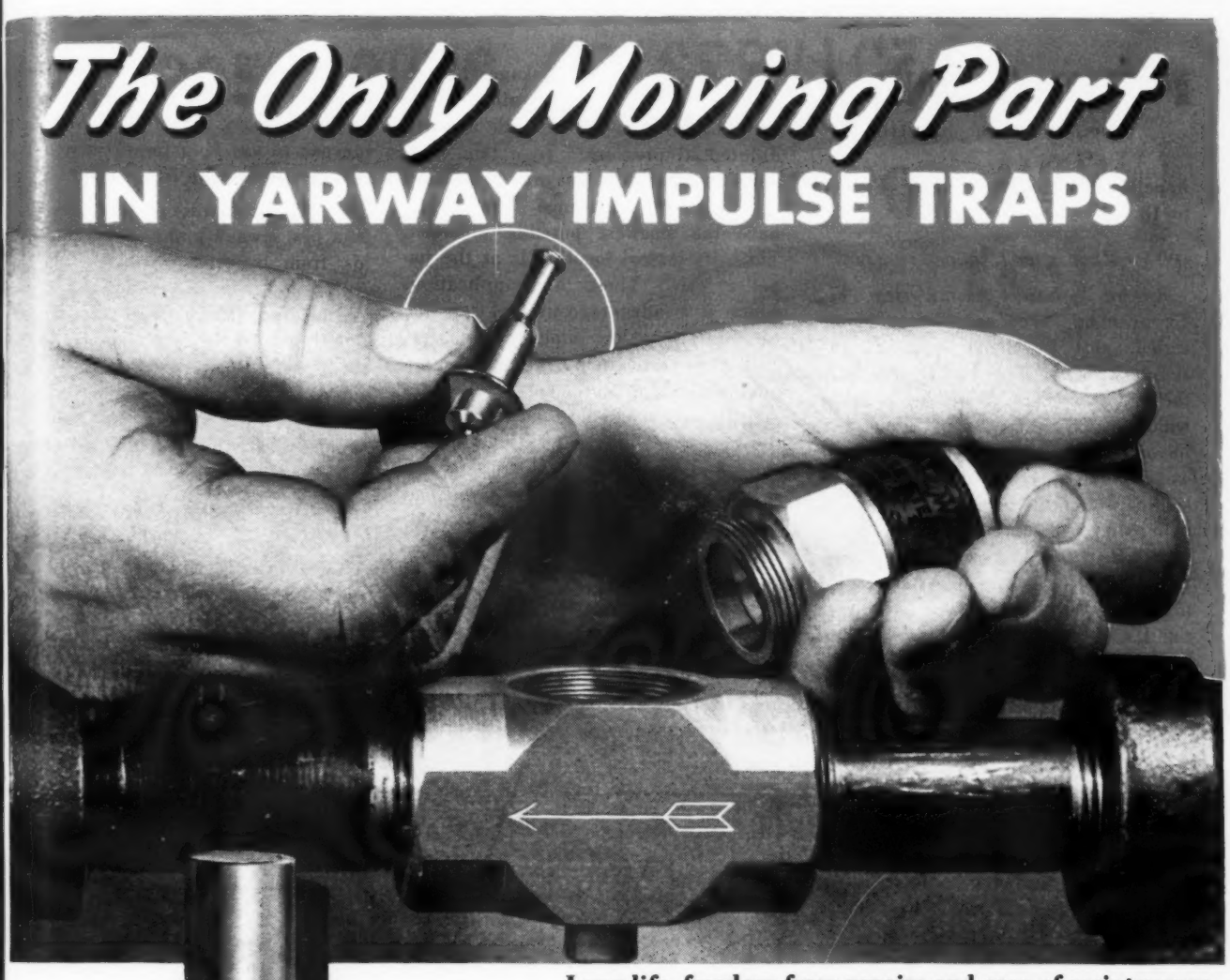
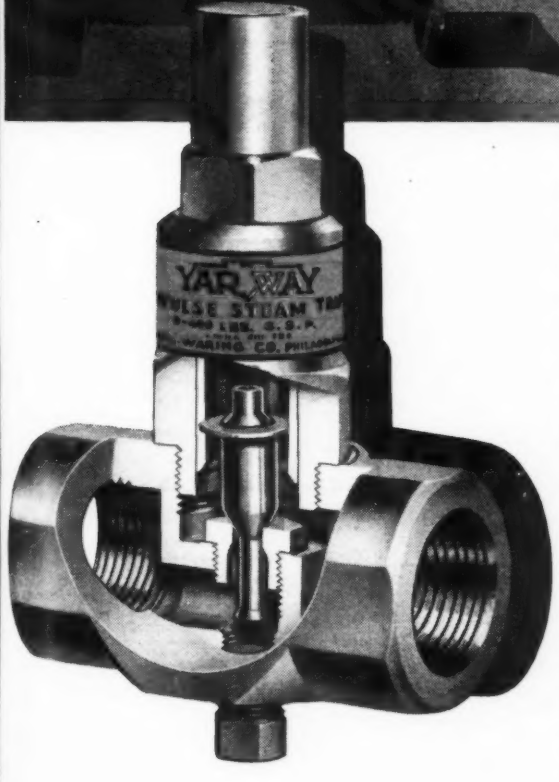


Fig. 7—End-suction pump arranged with removable suction head. Fig. 8—End-suction pump with removable stuffing-box head. Fig. 9—Vertical end-suction pump has removable suction and stuffing-box head. Fig. 10—Casing side plates of this end-suction pump provide close clearance for impeller

The Only Moving Part
IN YARWAY IMPULSE TRAPS





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YARWAY IMPULSE STEAM TRAP

PUMP Q AND A

(*Continued from page* 116)

impeller and in the casing Fig. 14 to 18.

Q 13—*What is an L-shaped ring?*

A—An L-shaped casing ring, Fig. 13, or nozzle type as it is commonly called, gets its name from its "L" shape, with the short bar *B* parallel to the radial surface *R* of the impeller, which would otherwise be exposed to incoming flow. This construction avoids wearing-ring leakage coming into the suction stream at an angle almost perpendicular to it, and causing eddy current and hydraulic losses. The leakage joint is along the L's long bar from *L* to L_1, with large clearance *C* between the L's short bar, to avoid losses because of high-velocity leakage at right angles to the suction flow line. An L-shaped ring is basically a flat ring with a protecting apron. The construction, Fig. 14, uses L-shaped wearing rings in the casing and on the impeller.

Q 14—*What is a labyrinth ring?*

A—It has two or more annular clearance leakage joints connected by relief chambers, Fig. 15. As the leakage through the clearance between two rings depends on its area and the length, leakage path of the labyrinth-ring permits a larger clearance between the rotating and stationary rings and still keeps leakage to a low value. The step-ring, Fig. 17, (not commonly used) and the intermeshing ring, Fig. 18, (often used), are other forms of labyrinth rings.

Q 15—*What is an intermeshing ring?*

A—A labyrinth ring with two annular clearance joints of different diameters involving a reversal of flow is often called an intermeshing ring, Fig. 18.

Q 16—*What is a step ring?*

A—It is the name applied to a wearing-ring design utilizing, in effect, two flat ring elements of slightly different diameters on the total width of a leakage joint. It is not very commonly used, and could be classified as a subdivision of the labyrinth ring group, Fig. 17.

Q 17—*Is location of the wearing rings restricted to the impeller suction eye, or can they be placed near the impeller discharge?*

A—The amount of leakage through a clearance joint is controlled by its area, the length of the path and the differential pressure. To obtain minimum area so that leakage will be a minimum, the clearance joint should have the smallest possible diameter. Thus, its logical location is at the impeller eye. There are applications where it is advantageous to locate the wearing ring at the impeller discharge, such as in vertical single-bottom-suction pumps handling water containing sand or grit, which will be idle at times. If the rings are located at the impeller eye, sand or grit may accumulate between the impeller and suction-head wall. When such a pump is started, the sand will cause rapid wear of the sealing rings and may do other damage. Besides having the disadvantage of increased area and rubbing speed, wearing rings at the impeller's periphery are objectionable in commercial lines of pumps, because in small sizes impeller diameters vary widely.

Q 18—*If it is feasible to have wearing rings at both the impeller eye and periphery, why wouldn't it be advantageous to use both locations and thus reduce the leakage loss?*

A—This construction has been used in a few sewage pumps to exclude solids from the space between the impeller and side walls and to reduce sealing-ring wear, which is relatively rapid because of grit. It could not be advantageously used for high-head pumps as the outer rings increase the rotating surface area to cause an additional disk-friction loss that offsets any saving in leakage.

Q 19—*Are rings with axial clearance practical?*

A—Rings with axial clearances have been used for centrifugal pumps but have not been as popular with designers or purchasers as those with radial clearances, Fig. 14 to 18. Because of variations in castings it is generally desired

(*Continued on page* 136)

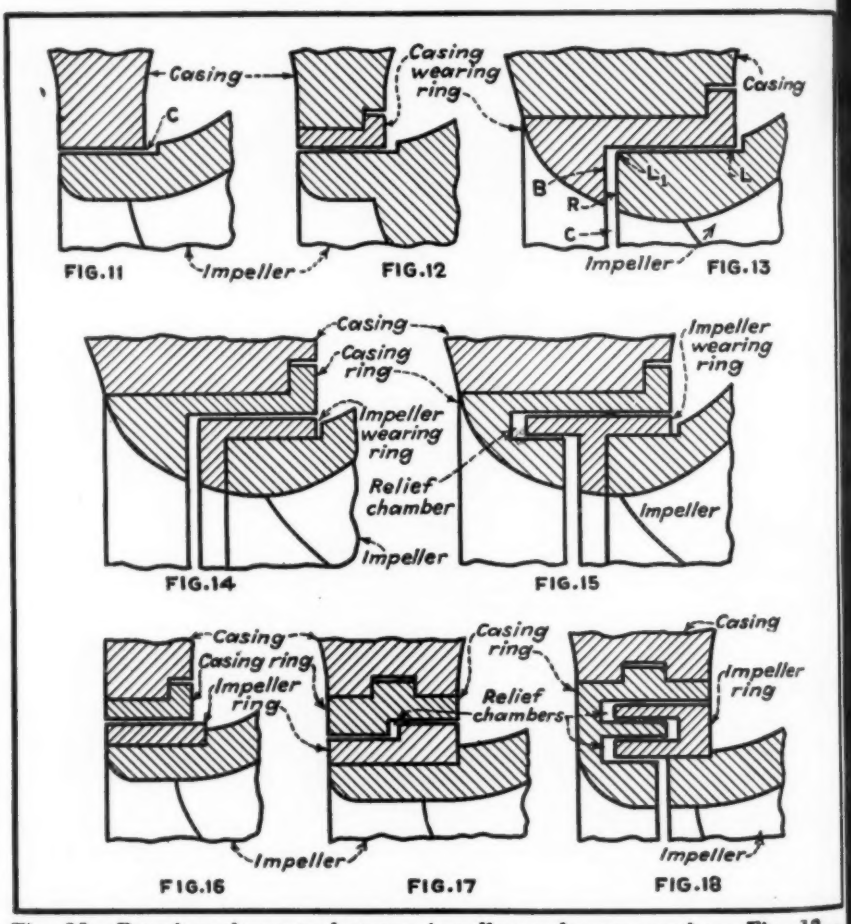

Fig. 11—Running clearance between impeller and pump casing. Fig. 12—Flat wearing ring in pump casing. Fig. 13—L-shaped wearing ring in casing. Fig. 14—L-shaped casing and impeller wearing rings prevent leakage through clearance contacting the suction stream at high velocity. Fig. 15, 17 and 18—Labyrinth casing and impeller wearing rings increase leakage-path length to keep leakage low. Fig. 16—Flat wearing rings in casing and on impeller

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REFRIGERATION NOTEBOOK — 20

Conditioned Air Betters Hospital Operating Rooms

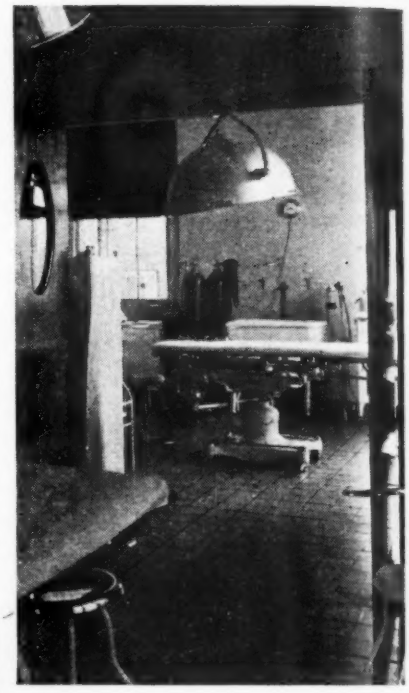
By TERRY MITCHELL, ME, *Frick Company*

ALTHOUGH THE EXPENSE of air conditioning an entire hospital is usually felt to be prohibitive, the improved results obtained by controlled weather in operating rooms make its installation worth while. However, the job cannot be done by simply placing in the room an ordinary unit-type air conditioner: a study of the requirements will make it clear that lowering the temperature is only part of the story.

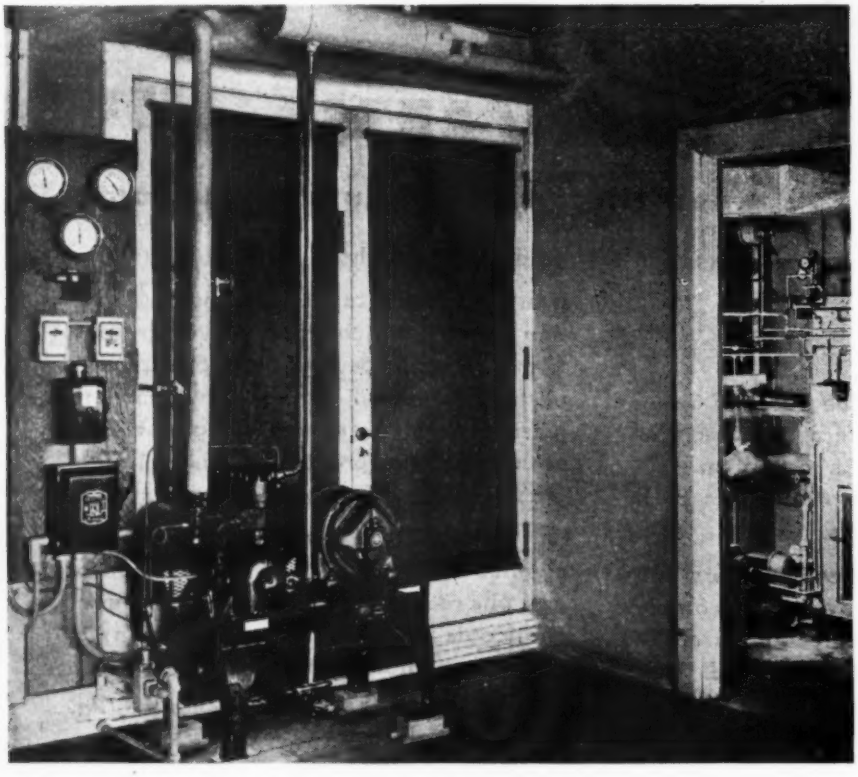
To avoid dehydration of wounds, and danger of explosions from sparks of static electricity (which have been fatal in over 200 cases) the patient needs air with relatively high humidity. And he needs very warm, very clean air, distributed without drafts. The surgeon and nurses, on the other hand, need conditions that are both cooler and drier, with plenty of fresh air to carry away the fumes of the anesthetic.

Experience has shown that the most satisfactory compromise is to keep the relative humidity at 55 to 60%, and the dry-bulb temperature at 78 F (somewhat higher in summer, and in hot climates). The air should be cleaned in the most effective kind of filter that the appropriation will provide. Filter should be of ample size, and easily washed or renewed.

While some installations use one-half fresh and one-half recirculated air, the latest practice is to distribute enough all-fresh air to give eight to twelve complete changes in the room per hour. The air preferably enters through a ceiling anemostat or similar device, placed above the surgeon's head. It escapes through loose swinging doors that lead into the sterilizing room, or through grilles that are placed near the floor of the room.



Conditioned air enters the operating room through a suitable device above the surgeon's head. He and the nurses need cooler, drier conditions than the patient does, with plenty of fresh air to carry away anesthetic fumes



Fully automatic refrigerating unit complete with necessary pressure gages serves the unit air conditioner located inside the doorway at the right. A study of requirements shows that lowering the temperature is only part of the story. Weather conditions in the operating room can be controlled so that they will be right for the patient as well as the operating staff

The controls should give modulated regulation of the temperature and humidity, either independently or together. Frequent starting and stopping (short-cycling) of the refrigerating machine and fan during a surgical operation are to be avoided.

High- and low-pressure cutouts should be provided for the cooling unit, along with pressure gages, backpressure control valve, isolation pads, non-sweat insulation for suction lines, sound-proofed air ducts, and explosion-proof switches in the operating room. Any motors in that space should also be explosion-proof.

The control system can be all-electric, or combine electric with pneumatic features. Equipment must be provided to add heat and humidity to the operating room whenever needed.

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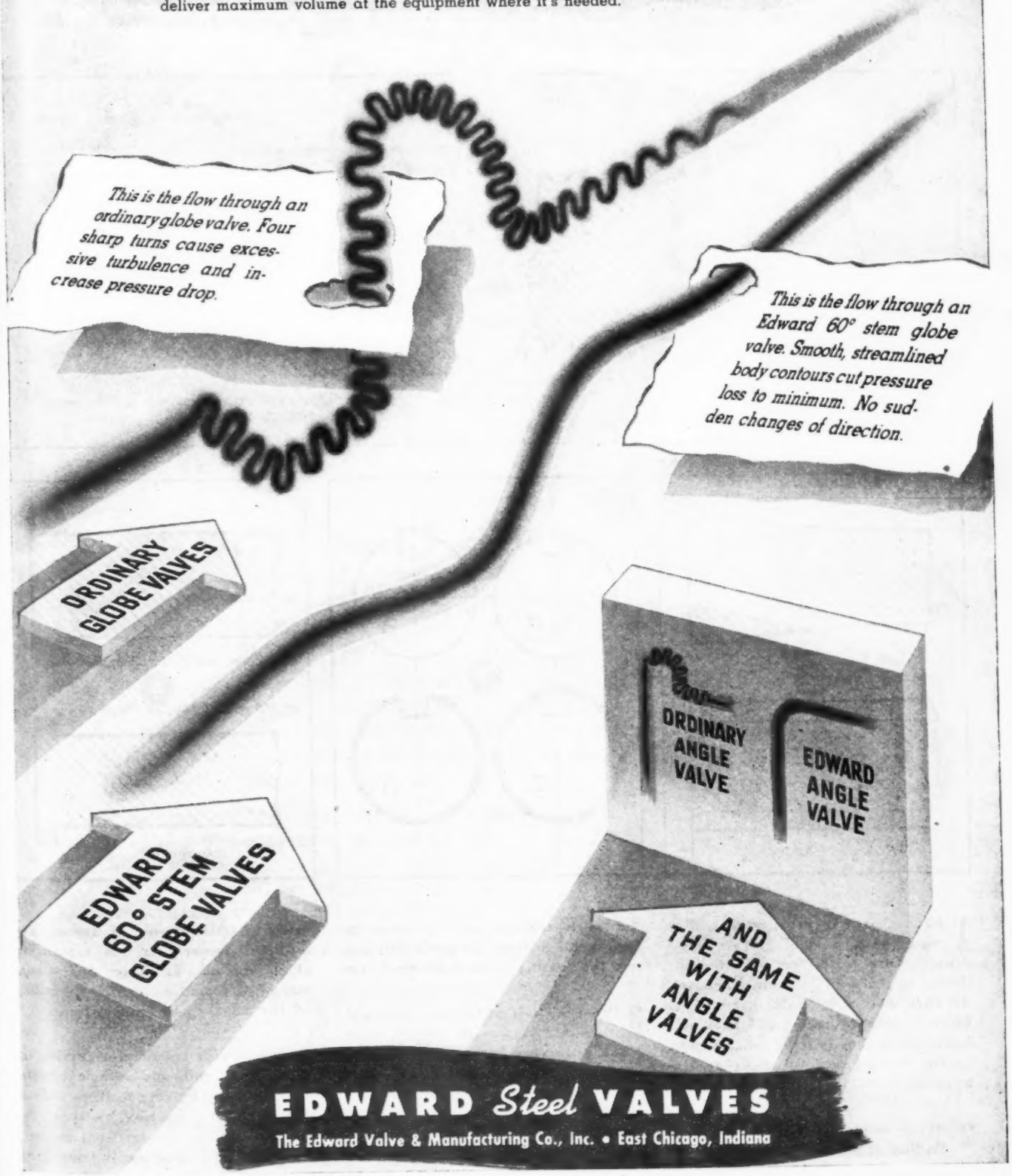
This is the flow through an ordinary globe valve. Four sharp turns cause excessive turbulence and increase pressure drop.
This is the flow through an Edward 60° stem globe valve. Smooth, streamlined body contours cut pressure loss to minimum. No sudden changes of direction.
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ORDINARY ANGLE VALVE
EDWARD ANGLE VALVE
AND THE SAME WITH ANGLE VALVES

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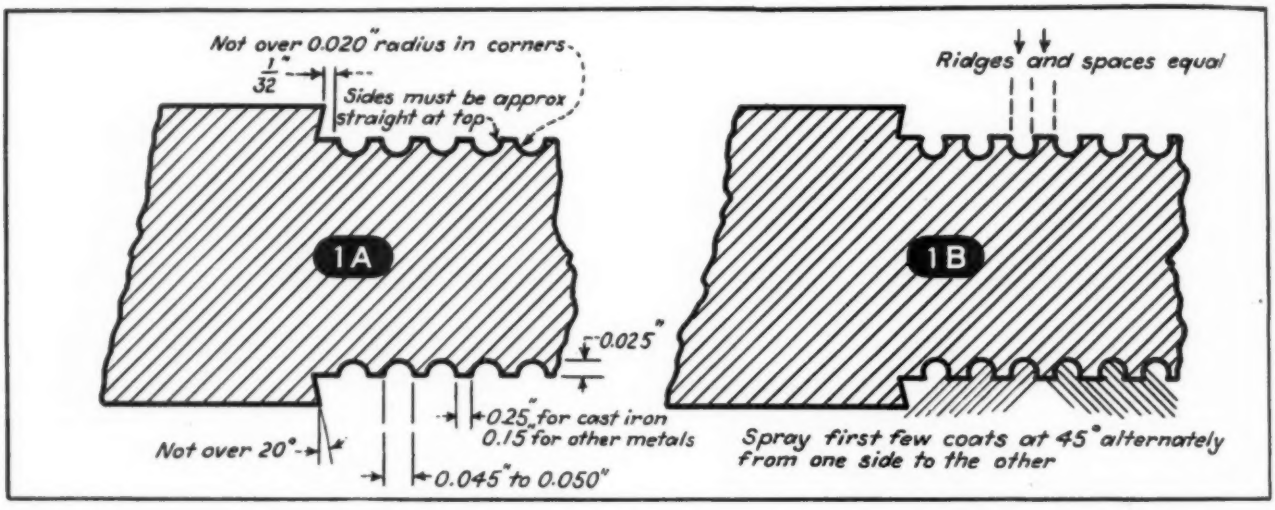
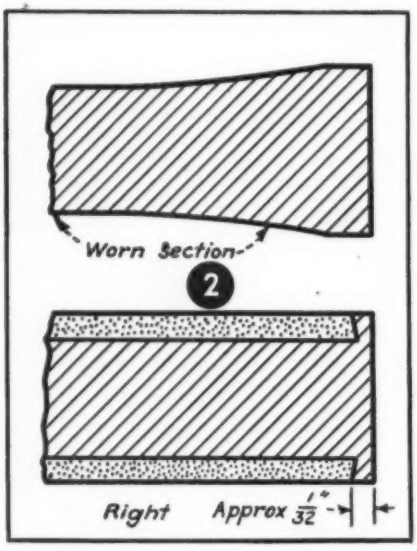
HOW TO USE METAL SPRAY TO REPAIR SHAFTS

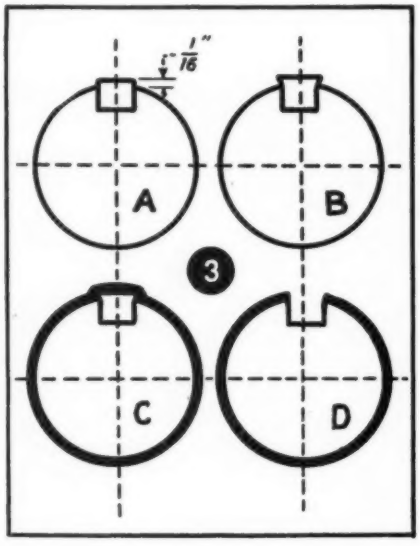
PREPARE a shaft for metal spraying by (1) machining the surface deep enough to receive the coating (2) grooving the parent metal to secure a tight bond. Keying or dovetailing into the parent metal is important because sprayed metal has fairly low tensile strength.

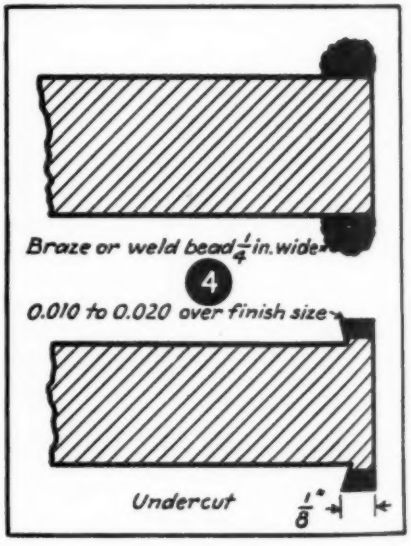
Sprayed coating must never taper off to a feather edge. When builtup section extends to the end of a shaft always provide a dovetail either from parent metal or a welded bead around the end.

When the shaft end must work against pressure, as in a pump plunger or hydraulic ram, end of the coating must always be dovetailed to prevent liquid pressure from lifting it. *Courtesy of Metallizing Engineering Co, Inc.*


Not over 0.020" radius in corners
1/32"
Sides must be approx straight at top
1A
Ridges and spaces equal
1B
0.025"
0.25" for cast iron
0.15 for other metals
Not over 20°
0.045" to 0.050"
Spray first few coats at 45° alternately from one side to the other







1 Groove area to be sprayed with a round-pointed tool that has straight sides. Cut either a continuous thread or series of individual grooves, *A*. Then run a special rotary wheel (do not use a knurling tool) back and forth across the shaft to roughen and spread the ridges to form slight overhang dovetails at the grooves, *B*.

2 Never build up worn sections to a feather edge. Instead, machine off the worn surface and undercut the base metal to form dovetails that protect the coating against lifting forces.

3 Prepare shaft at keyways as usual; then file keyway to remove burrs. Make a dummy key from cold-rolled steel, polish smooth with emery cloth, and put it in the keyway, *A*. Peen the edges, *B*, to facilitate the key's removal and chamfer the sprayed-coating edges. After spraying, machine and grind to finished size. If dummy key is fitted securely it can remain in place during finishing operations; otherwise, remove it after grinding off the ridge, *C*, by tapping lightly.

4 When wear requires machining up to shaft end, add sufficient metal by welding or brazing to form a dovetail ring. After brazing, machine the dovetail groove, but let final machining wait until spraying is completed.

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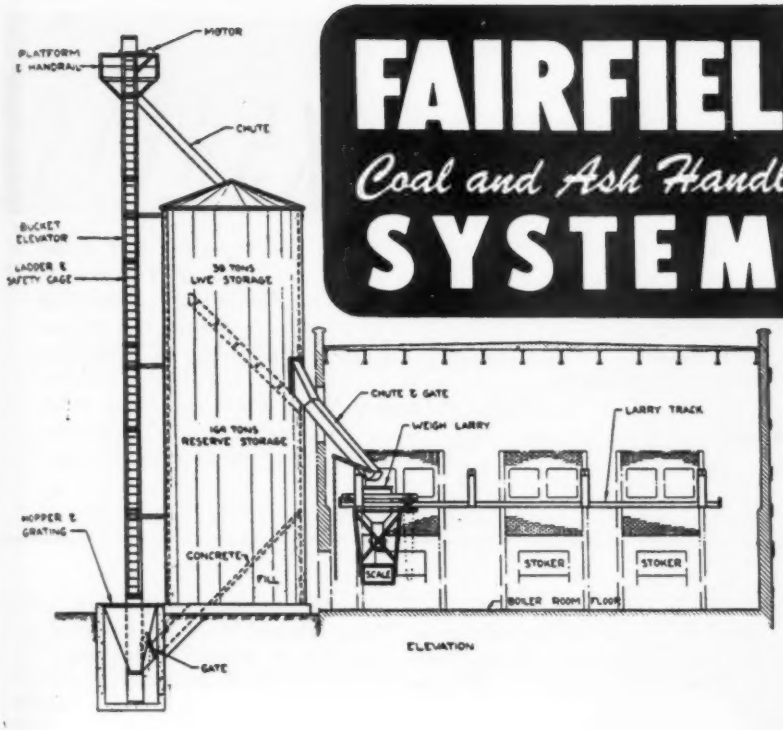
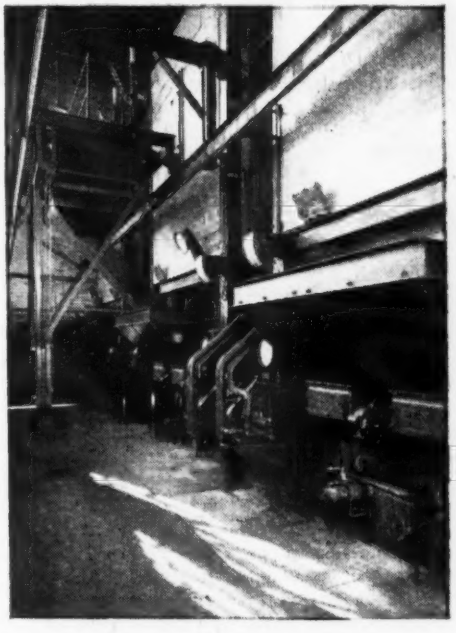
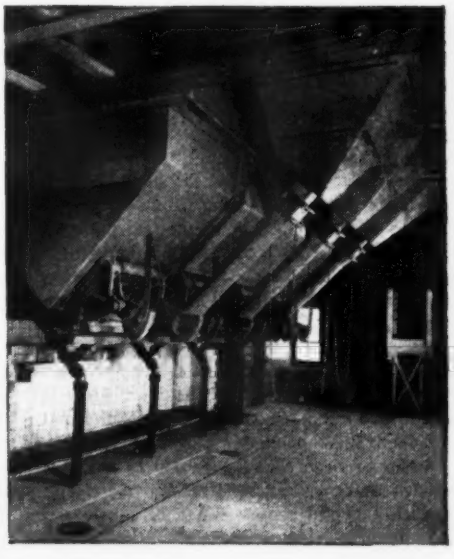
SYSTEMS







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THE MODERN GAS TURBINE ..... *By R Tom Sawyer*
HOW TO SOLVE PUMPING PROBLEMS ..... *Pub by Geo D Roper Corp*
ELECTRICAL DRAFTING ..... *By D Walter Van Gieson*
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ASTM STANDARDS ..... *Pub by Am Society for Testing Materials*
BOOKLETS ..... *Brief Reviews*

Air Compressors

AIR COMPRESSORS, THEIR INSTALLATION, OPERATION AND MAINTENANCE (1944) *By Eugene W F Feller, associate editor of* POWER. *Pub by McGraw-Hill Book Co, Inc, 330 W 42nd St, New York 18, N. Y. 460 pp, 5x8¼, 414 illustrations, cloth.* $4.50.

A complete, practical treatment of the subject tells the production superintendent how to check up on his air supply, the engineer how to select and operate his machines, and the student how to understand the mechanics of every kind of air compressor.

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Gas Turbines

THE MODERN GAS TURBINE (1945). *By R Tom Sawyer, American Locomotive Co. Published by Prentice-Hall, Inc, 70 Fifth Ave, New York, N. Y. 216 pp, 6x9 in., illustrated.* $4.

All the information that can yet be printed on gas turbines for land, sea and air. Describes modern types of stationary power units, chemical process machines, locomotive and ship drives. Reviews historical development of gas turbine over 150 years of inventions. Includes chapters on supercharging of diesel and aircraft engines, jet propulsion of aircraft.

Not intended for designers, this book explains the principles of gas turbine construction and operation in simple language without mathematics or thermodynamics of a complicated nature. Recommended reading for anyone with a genuine interest in the future of gas-turbine application.

ABC's of Pumps

HOW TO SOLVE PUMPING PROBLEMS (1945) *Published by Geo D Roper Corp, Rockford, Ill. 30 pp, 8½x11 in., illustrated, tables, paper binding. Free.*

Here is a book to aid beginner as well as experienced pump engineer. It outlines, step by step, the basic fundamentals in estimating the requirements of the average pumping job. By simple language and the example method, it explains the formula used in figuring suction lift and discharge head. It gives information on estimating horsepower requirements, and the size and speed of pulleys. Technical charts and tables show friction loss in pipes, viscosity, viscosity conversion, wiring data and fuse sizes. Helpful hints for installing pumps and tips on trouble-shooting are included.

The new book is devoid of advertising and can be had free without obligation by writing to the above address on your company's letterhead.

Drafting Technique

ELECTRICAL DRAFTING (1945) *By D Walter Van Gieson, Assistant Electrical Engineer, Board of Transportation, City of New York. Published by McGraw-Hill Book Co, 330 W 42nd St, New York, N. Y. 140 pp, 5½x8 in.; illustrated; cloth.* $1.50.

This book deals primarily with drafting technique as applied to electric-circuit diagrams and wiring plans, presented as a series of illustrated discussions. They start with the schematic circuit diagram and develop the detailed wiring plans for several typical cases, correlating conduit and equipment location plans.

The first four chapters cover symbols for electrical and electronic devices and the use of schematic diagrams. Following are 13 chapters on drawing for specified jobs, such as lighting, power, switchboard, signal, communication and other systems of wiring. The eight closing chapters treat equipment-location plans, specifications, office practice, drafting kinks and allied subjects. Because the subjects are presented in easily understood language even the beginner will find the book useful.

Dam Engineering

ENGINEERING FOR DAMS (1945) *Three vol. Vol I—General Design; vol II—Concrete Dams; vol III—Earth, Rock-Fill, Steel and Timber Dams. By William P Creager, consulting engineer, Joel D Justin, consulting engineer, and Julian Hinds, general manager and chief engineer, Metropolitan Water District of S. Calif. Pub by John Wiley & Sons, 440-4th Ave, New York, N. Y. Illustrated, tables, cloth. Vol, I, 283 pp, $4,50; vol II, 418 pp, $6; vol III, 349 pp, $6.*

(*Continued on page 142*)

Plan on COPPER

when you plan new

circulating lines

low-pressure steam lines

hot water lines

air lines

pressure lubricating systems

sprinkler systems

BECAUSE COPPER TUBES insure freedom from rust and a high degree of corrosion resistance, they assure savings in maintenance and the cost of premature replacement. Copper tubes effect important savings in installation costs as well through the use of solder type fittings, long tube lengths and the fact that, in the smaller sizes. these tubes can be bent around obstructions.

Inspection of copper tubes which have been in service for a number of years reveals smooth interior surfaces—free of built-up deposits. To the plant engineer, this means a reduced resistance to flow and consequently lower pumping costs.

It is none too soon to look ahead, and plan ahead for the day when Anaconda Copper Tubes will again be available for peacetime projects. Publication C-24, sent on request describes many industrial applications.

4572

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AMERICAN VIBRATION ELIMINATORS

American Vibration Eliminators exclude vibration and compensate for thermal expansion in pipe systems.

Pressure-tight, safe for conveying costly gases or liquids, such as refrigerants, American Vibration Eliminators are easily installed. For catalogue, write American Metal Hose Branch, Waterbury 88, Connecticut.

ANACONDA *Anaconda Copper Tubes*

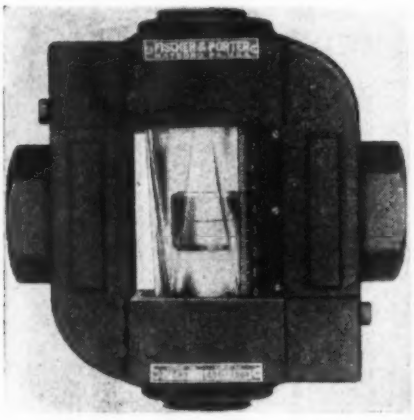
THE AMERICAN BRASS COMPANY—General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company • In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

What's New in Plant Equipment

Flow Indicator

ROTASIGHT FLOW-RATE INDICATOR is rapidly replacing bullseye sight-flow indicators because it indicates true flow rate, according to maker. When *Rotasight* float is at



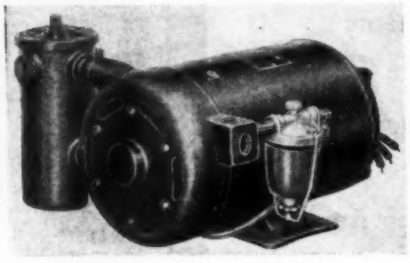
bottom of tube, it practically seals off tube so that float must rise when flow starts and thus indicate low flows. In addition, tube has V-port flutes which increase in flow area as float rises, making *Rotasight* an area meter. For every flow rate there is a definite float position and flow changes are instantaneously shown by float movement to new position. Flow range of 10 to 1 from maximum to minimum flow is readily obtained. At all flows, float rides close to four guiding glass ridges, which are arcs of a true circle. Therefore, when measuring an opaque fluid, float position can always be seen by looking at it from the outside through glass ridges.

Rotasight may serve as a flow-rate alarm. Manufacturer claims that it is the only alarm that is operated by flow-rate changes only and that is equally sensitive at all points in flow range because of its straight-line calibration. *Fischer & Porter Co, 960 County Line Rd, Hatboro, Pa.*

High-Lift Pop Valves

POP RELIEF VALVES are said to have an exceptionally high coefficient of lift, which is secured through unique design of valve disk, by which fluid velocity is entrapped; its kinetic force is converted into additional lift for higher relief discharge. New Farris pop valves, No. 1800, in sizes ¼ to 2½ in. for pressures up to 300 psi, are already in use on steam, air, gas, water and other liquid process lines. Valves are built with an adjustable single blowdown ring, which permits regulation of pressure amount to be relieved on individual operations. Valves have long, accurately calibrated carbon-steel springs. They are also available with a handwheel for easy and accurate pop adjustments on jobs requiring frequent changes of operating pressures, or with packed adjusting bolt under a protecting cap for gas service.

Farris pop valve No. 1840, although somewhat smaller, is similar in general appearance to those above described. However, this valve is built without an adjustable blowdown ring, which is replaced by a predetermined orifice. Primarily designed for equipment manufacturers or others requiring low first-cost, this utility valve is made in sizes ⅜ to 1 in. *Farris Engrg Co, 345 Commercial Ave, Palisades Park, N. J.*



Vacuum Pump or Compressor

MOTOAIR IS CLASSED as a rotary-vane pump. Pump casing, mounted on motor housing, operates on standard motor shaft. Blades operate by centrifugal force, in slots cut in rotor. Vacuum lines are set in pump inlet and pressure lines to pump outlet. Intake suction maintains continuous oil circulation through pump and back through return line. Air impinges against a baffle thereby separating oil from air, which is further cleaned by cotton waste. Utilizing a line on inlet and another line on outlet permits *Motoair* to supply both vacuum and pressure at same time. Where necessary, a bag-type intake filter may be supplied to catch incoming dirt.

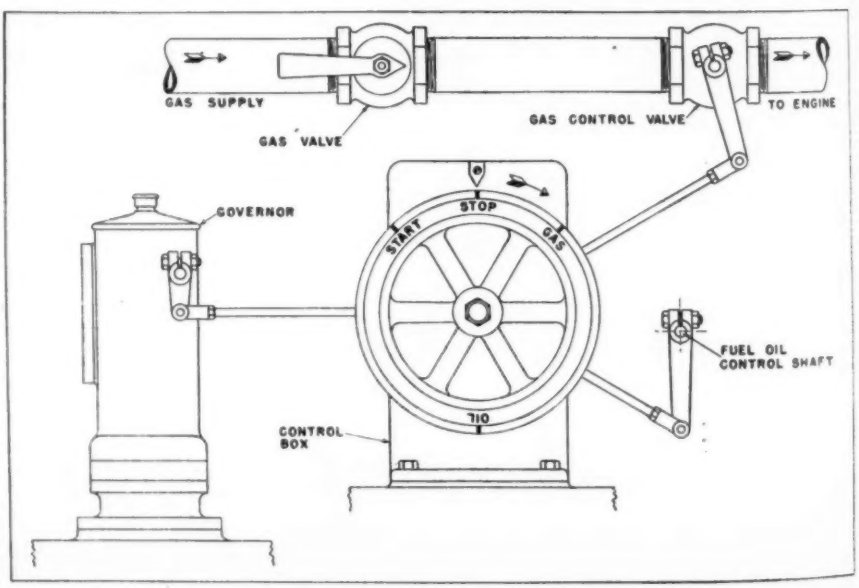
Motoairs can be ordered for any of following electrical characteristics: (1) 110-220 v, ac, repulsion induction, single phase, 60 cycle (2) 220-440 v, ac, 2 phase, 50-60 cycle (3) 220-440 v, ac, 3 phase, 50-60 cycle (4) 550 v, ac, 3 phase 50-60 cycle (5) 115-v dc (6) 230-v dc. Units for special electrical characteristics may be supplied. *Motoair Div, New Jersey Machine Corp, 1505 Willow Ave, Hoboken, New Jersey.*

Dual-Fuel Engine

INSTANTANEOUS CONVERSION of a diesel from oil to gas fuel, or operation on a combination of these fuels, is made possible by new Cooper-Bessemer development. This gives diesel efficiency of about 35% on gaseous fuels, cutting gas consumption by 20 to 25%, compared with spark-ignition gas engines.

Pre-ignition, expected to result if gas were admitted at low pressure with intake air and the mixture compressed to diesel pressure of about 400 psi, seemed to bar this design. Although temperature produced by diesel compression is below theoretical ignition point of perfect gas-air mixture, combustion-chamber hot spots cause pre-ignition with close-to-theoretical mixtures used in gas engines. However, it was found that when operating with the high excess air characteristics of diesels, the lean mixture resulting ignited much less easily. This means that a gas-air mixture can be admitted and highly compressed without pre-ignition. Pilot oil is injected to start ignition. Diagram shows controls for such an application.

(*Continued on page* 160)



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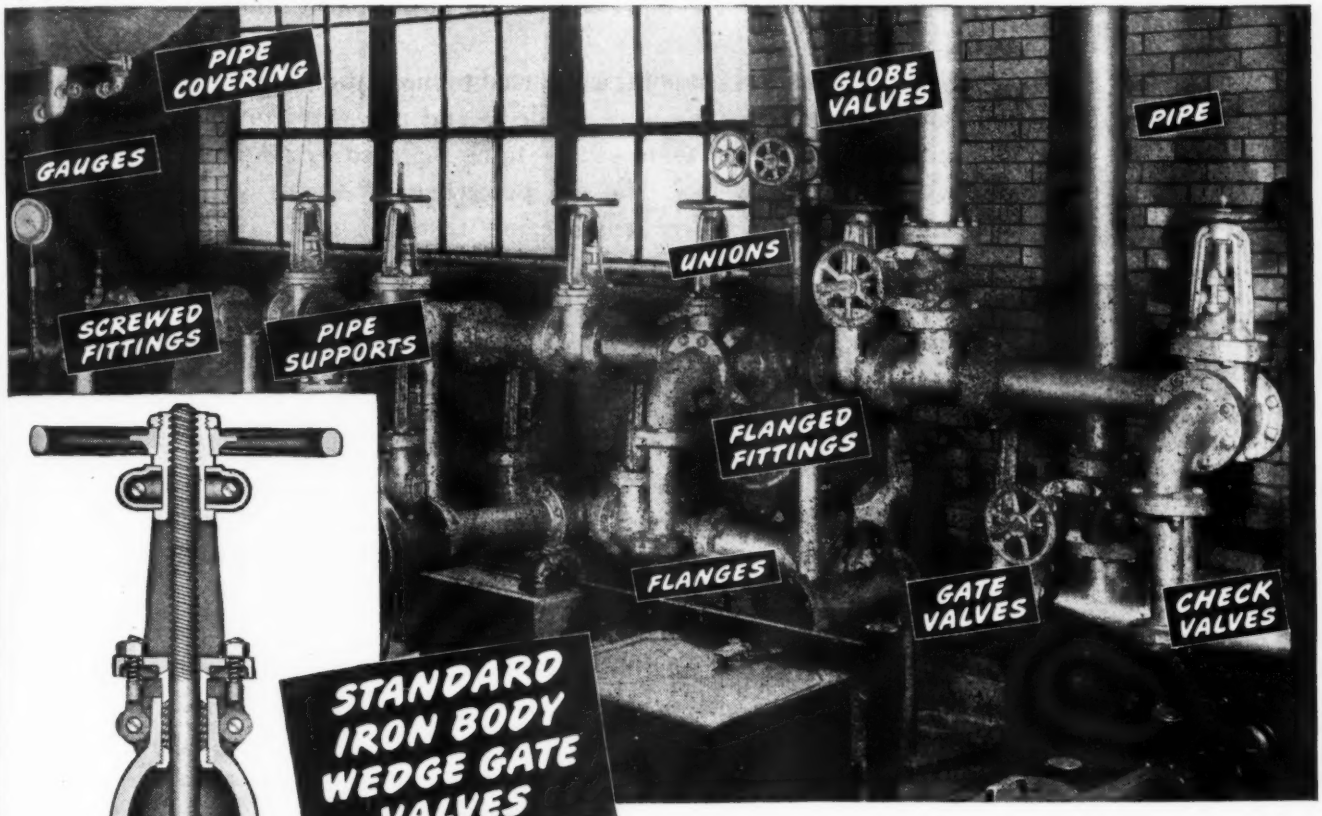
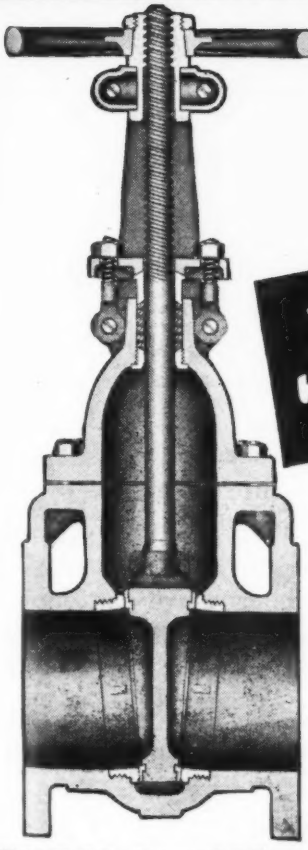
No matter what you need in piping materials, you can get them *all* from a single source—your Crane Branch or Wholesaler. There, the world's greatest selection of piping materials —in brass, iron and steel—is at your service. Uniform quality in every part—backed by a single responsibility—helps assure the best installation. Take advantage of Crane *complete* piping materials service to speed up deferred replacement work and keep pipe lines at peak efficiency. Crane has everything you need; for example, in Standard Iron Body Wedge Gate Valves, as shown below.

Piping hook-up for a battery of pumps





STANDARD IRON BODY WEDGE GATE VALVES

SERVICE RECOMMENDATIONS: **Crane Standard Iron Body Wedge Gate Valves** with Brass trim are recommended for steam, water or oil lines; all-iron valves for oil, gas or fluids that corrode brass but not iron. Made in O. S. & Y. and Non-Rising Stem patterns.

Working Pressures

Size of Valve	Screwed or Flanged Valves		Hub End Valves
	Saturated Steam	Cold Water, Oil, or Gas, Non-Shock	Cold Water or Gas Non-Shock
2 to 12 in.	125 pounds	200 pounds	200 pounds
14 and 16 in.	125 pounds	150 pounds	150 pounds
18 to 24 in.	*	150 pounds	150 pounds

*For steam lines larger than 16-inch, Crane 150-pound Cast Steel Gate Valves are recommended.

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Second Revolution . . .

A lot of us have lived through a power revolution. I remember when my job involved principally a boiler, a steam engine and a lineshaft. That engine had to run, or the whole place shut down. We had a couple of steam pumps and a steam compressor in the powerhouse, too—and that was the works.

When turbines and motors came in, we started to move the compressors and pumps out to wherever they were needed—and run wires to them. Out, too, went the long lineshaft—to scrap—to be replaced by motors on the loads, wherever they were. The old powerhouse literally spread itself all over the plant. Power engineering takes a lot more legs than it used to.

I think it's important to realize that things have changed when you begin your postwar planning. They say a postwar planner is a fellow who pursues an indefinite idea to an impossible conclusion, so let's just call ours postwar "thinking."

The pattern of tomorrow's *generation* of power services is now pretty well defined. We can add a percent or two in efficiency of boilers and turbines, we can get better compressors and pumps, electronic controls and the like. We may get gas turbines or dual-fuel diesels. These will all help get just a little more out of a pound of fuel than we did.

But in transmission and application the pattern is not nearly so definite. Piping, wiring, insulation, couplings, converters, speed reducers, electronic gadgets, new materials—all these throw a challenge. We've got to pick and choose amongst them for each of the dozens of transmission and application jobs we'll be doing to suit our own company's new or improved products.

It's a job that takes careful thinking and planning so we can be ready when the users of our services reconvert. There's no use clinging fanatically to some old-fashioned idea, to some belief that this or that is just a fad—because a fanatic is a fellow who redoubles his efforts after he's lost sight of his objective. We've got to remember we've already survived a pretty big power revolution, and keep open minds on methods and equipment in the months to come.

George Edwards
Engineer

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showing the
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NOW, you can see at a glance the recommended material for every temperature range, from minus 400° F. to plus 2600° F.

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Each material in this J-M group of insulations is tailor-made to do one special job *best.* And, as part of the Johns-Manville Insulation Service, J-M specialists are available to help you with present insulation problems . . . or with those connected with future plans.

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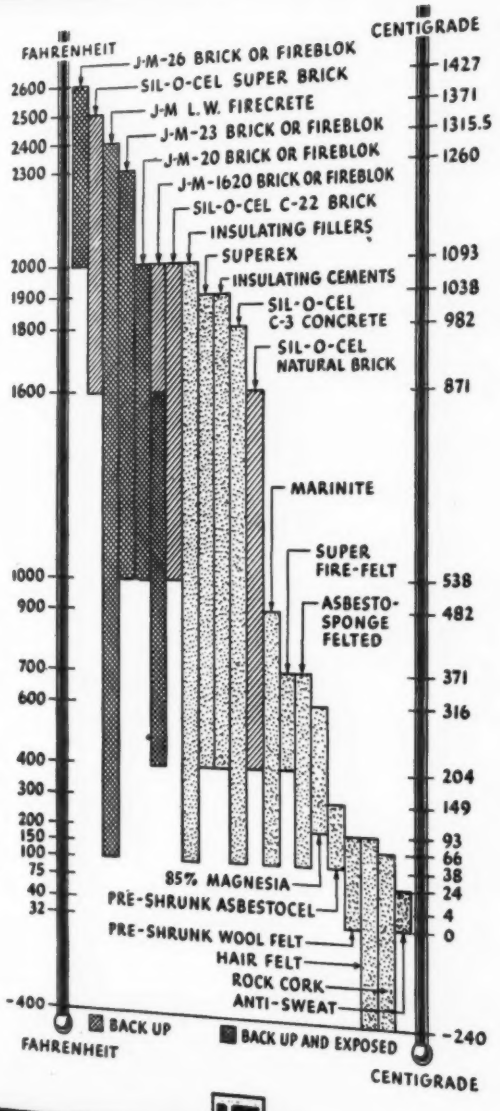

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POWER NEWS

BUSINESS ITEMS AND APPOINTMENTS • WASHINGTON NOTES

FOREIGN FIELDS • MODERNIZATION • FUEL CONSERVATION

More Aluminum With No Power Difficulties

An official of the Office of War Utilities reports that War Production Board's order that four aluminum plants manufacture a total of 10,000,000 lb of pig aluminum more per month than has been produced recently will not entail any power supply difficulties. Most of the additional production will be at the Defense Plant Corp's Spokane plant, where energy will be obtained from Bonneville Power Administration. Next largest amount will be made at Aluminum Co's Massena, N. Y., plant, which will import hydro energy from Canada.

Alcoa plants at Badin, N. C., and Niagara Falls, N. Y., also will produce a little. At Badin, Alcoa has surplus hydro energy now used for fuel displacement. Net fuel increase here will be smaller than amount of energy required for high line losses if the excess hydro had been moved to neighboring load centers for additional aluminum production. At Niagara Falls, production in one pot line not heretofore operating at capacity will be stepped up. This production will be served by hydro energy from a dc generator that could not otherwise be used.

Coal-Priority List Rates Various Utilities

Electric and other utilities rank second on an emergency coal-priority list developed by War Production Board at request of Solid Fuels Administration for War. WPB Chairman J. A. Krug emphasized that it will be invoked only in emergencies.

Heading the list are industries that may require coal to prevent irreparable damage to equipment, that is, coke ovens or blast furnaces, which would be ruined if they were abruptly taken out of service when a coal pile gave out. No distinction is made between less essential and more essential industries in this category, but impending damage to equipment must be demonstrable.

Transportation facilities, including ships requiring bunker fuel, and other utilities rate immediately behind this classification, again with no differentiation between members of the group. Domestic space-heating requirements and industries follow, with the latter classified according to essentiality. Seven categories of priority are established by this list, which was not made public.

The listing followed a request by Solid Fuels Administrator Harold L Ickes, who calculated that the country would face a 50,000,000-ton deficit in production this year. He estimates that 20,000,000 tons of this deficit will come from existing stockpiles. The remainder will have to be made up through savings. Ickes thus raised the deficit from the 25,000,000 tons anticipated by War Mobilization Director James F Byrnes in his request for a *brownout* of nonessential lighting.

Electric utilities have drawn down their stockpiles substantially during early months of 1945, in some cases as much as ten to fifteen days. Some companies still have large stocks, but mere curtailment of their purchases does not guarantee that the resulting free coal will find its way to those most in need, even though it does result in extra coal for allocation.

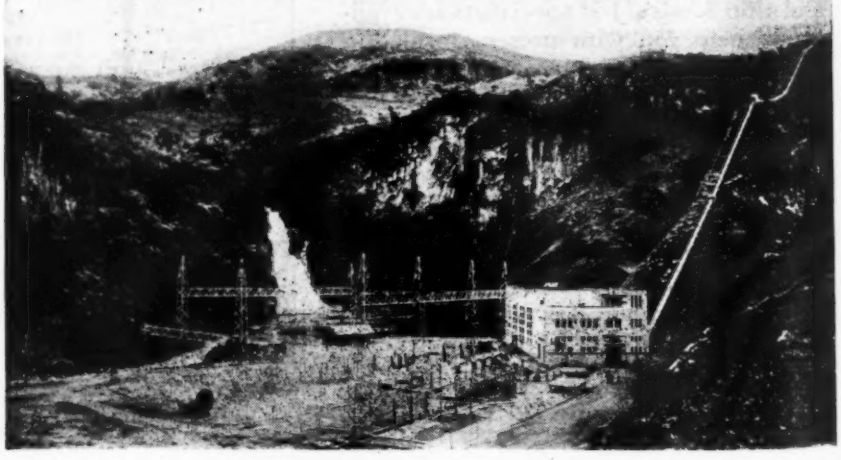
Production in Pennsylvania and Ohio has suffered because of the scarcity of railroad cars. In the southern Appalachian fields, however, car supply has been sufficiently good to allow some Sunday mining.

Soviet Receives Sixty Power Trains From U.S.

We shipped 60 power trains, with a capacity of 148,000 kw, to the Soviet Union in four months last summer and fall. The trains are complete units, with steam-generating equipment mounted on flat cars which can be moved from point to point easily. The 60 trains, nine of 5000-kw capacity, 26 of 3000-kw capacity and 25 of 1000-kw capacity, are part of a lend-lease power

(*Continued on page* 178)

MEXICAN HYDROELECTRIC POWER PLANT



New hydroelectric power plant, operating at highest head for Francis unit in the Western Hemisphere, will soon take Mexico City off power rationing. Baldwin Locomotive Works are now constructing the second of three turbines for Ixtapantongo Development of Comision Federal de Electricidad, located on the Tilostoc River about 100 miles southwest of Mexico City, which is to furnish power through Mexican Light and Power Co. Each turbine is to furnish 39,000 hp under a head of 1028 ft. First turbine has been installed and is in operation. This vertical-shaft Francis unit has a butterfly valve and Pelton relief valve to prevent pressure rises for load rejection

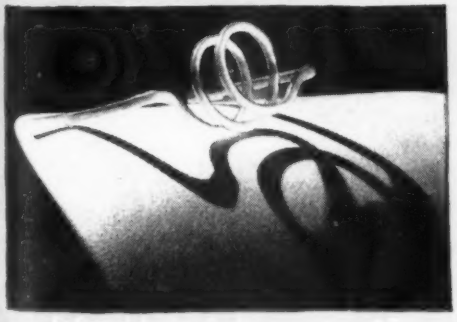
Patent Notice

Please take notice that United States Patent No. 2,358,222 issued September 12, 1944, has been assigned to National Aluminate Corporation. For your convenience, claims 1 and 15 are reproduced below as being somewhat typical of the 19 claims of this patent:

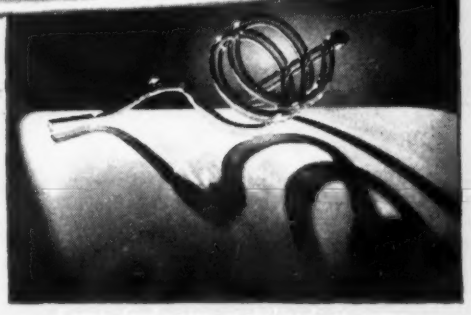
1 In the art of treating water for industrial consumption, the process of inhibiting deposition of alkaline earth compounds in passageways for the water having a total alkalinity that does not exceed the soap hardness by more than one hundred parts per million, expressed as $CaCO_3$, comprising, adding to the water, a polyphosphoric acid compound in an amount not exceeding nine parts per million and not exceeding thirty-five percent of the soap hardness of the water.

15 The herein described process of treating and heating a water which would otherwise precipitate calcium carbonate upon heating, which comprises, adding to the water a water-soluble molecularly dehydrated phosphate which has a dispersive effect upon calcium carbonate in an amount much less than that required for softening the water and not more than about 9 parts per million but sufficient to prevent the precipitation of calcium carbonate as a result of heating the water together with an organic dispersive agent which has a dispersive effect upon calcium orthophosphate, and thereafter heating the water so treated.

PATENT LICENSES, UNRESTRICTED AS TO SOURCES OF SUPPLY AND MATERIALS, BUT ON A ROYALTY BASIS, WILL BE GRANTED TO THOSE DESIRING TO PRACTICE THE SUBJECT MATTER OF UNITED STATES PATENT 2,358,222. APPLICATIONS FOR LICENSES SHOULD BE MADE TO NATIONAL ALUMINATE CORPORATION, 6218 WEST 66th PLACE, CHICAGO 38, ILLINOIS.

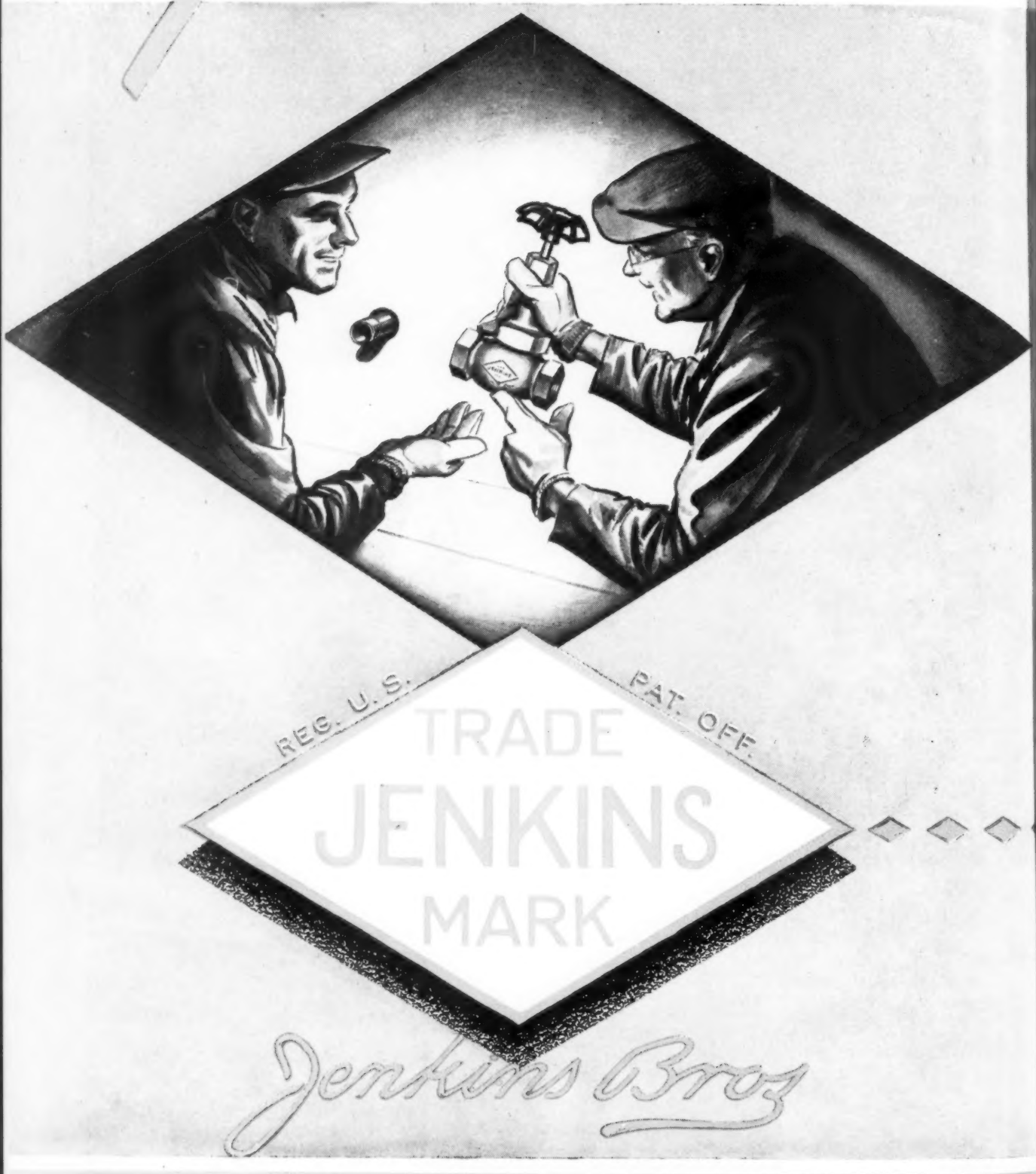


Stabilized feedwater treatment keeps feedwater lines clean—saves time and money and insures maximum economy and efficiency.



—System of Scientific Water Treating Service . . . for all industry

Your Guide to



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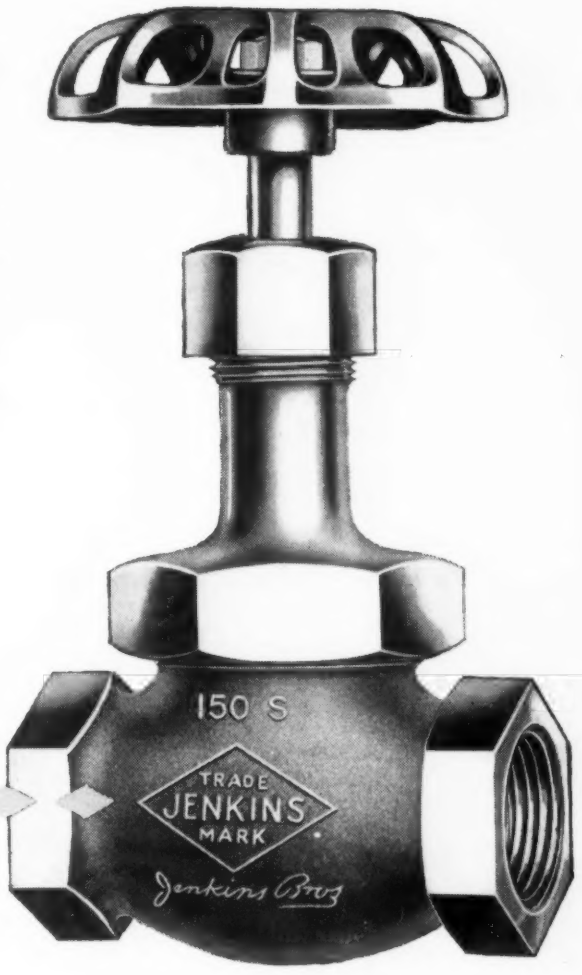
It is the mark that distinguishes valves of extra value . . . value assured by the superior materials that go into them, by the resourceful men who make them, by the integrity that has become synonymous with the name Jenkins.

Valves worthy of the universal trust the Jenkins Diamond has earned are the only valves that will ever bear this mark. It is our pledge to you of the finest quality it is possible to provide . . . now, and as long as Jenkins Valves are made.

Jenkins Bros., 80 White Street, New York 13; Bridgeport, Conn.; Atlanta, Boston, Philadelphia, Chicago. Jenkins Bros., Ltd., Montreal, London.



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BRONZE · IRON · STEEL

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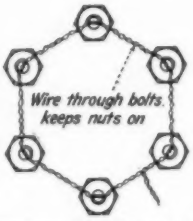
POWER'S DATA SHEETS

Number 152

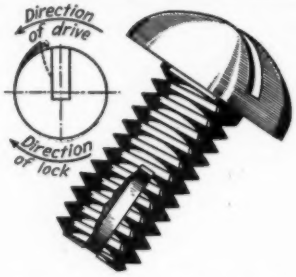
Typical Locking Methods

CASTELLATED NUT AND COTTER PIN

COOKE-MICRO SLOTTED NUT—This is a special design of castellated nut, the slots being arranged so that there are 14 to 22 locking positions.



WIRED LOCK—The bolts are drilled, the same as when castellated nuts are used, to permit a wire to be run through them.



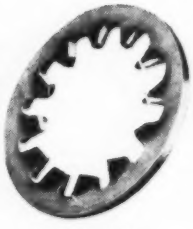
SHANK-LOCKING SCREWS have a slot cut in the lower part of the threaded section and spread apart so that there is a "bulge" which acts as a spring to produce a friction contact against the threads of the tapped hole.

PREASSEMBLED threaded fasteners and washers with both internal and external teeth are available to speed production.

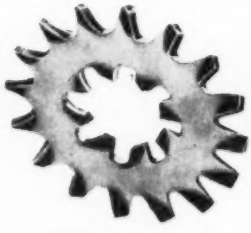
LOCKING FLANGE in Holtite fasteners is integral part of head. Various head types and fastener sizes are available.

INTERNAL AND EXTERNAL TEETH—Teeth embed in face of work and bolt. External-tooth type is more generally used; internal-tooth type is used where smooth outer edge is desired and for other specific applications.

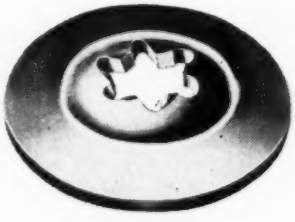
EXTERNAL



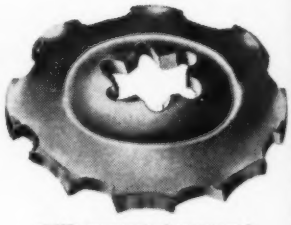
INTERNAL



EXTERNAL-INTERNAL



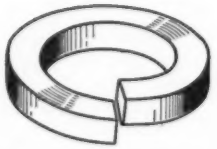
DOME INTERNAL



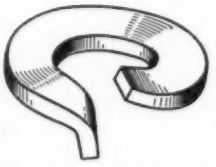
DOME EXTERNAL-INTERNAL

LOCK WASHERS

KANTLINK—A non-entangling spring lock washer used on all types of machinery and suitable for applications similar to Knolink type. Its angle-cut ends tend to embed more deeply and engage the nut face and bolted surface.

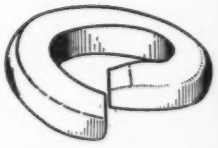


KNOLINK—A non-entangling spring lock washer suitable for general use and application on all types of automotive, farm implement, electrical, stove or industrial equipment, made in sizes to S.A.E. and Government AN-935 specifications similar to Kantlink type.

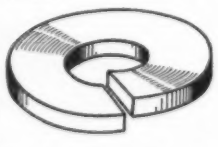


WOOD SPRING—Made in wide, thin surface sections. For use with nut, screw or bolt on soft surface material such as wood, rubber, plastics, fiber compositions or soft thin sheet metal. The anchor end embeds in the surface and turned-up end engages the nut, screw or bolt face.

RIBBED TYPE "C"—The rib on the inner periphery under compression wedges itself into the bolt thread and nut chamfer while introducing reactive pressure and tension in its assembly.

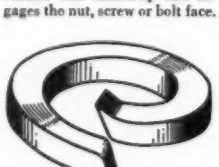


ROUND EDGE HY-CROME—Specially processed high-quality alloy-steel spring washer made to specification requirements for each bolt size. Rounded edges avoid heat cracks. Particularly suitable for use on high-quality product and for heavy-duty applications.



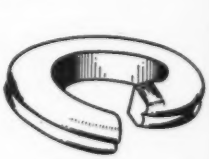
WIDE BEARING—For use in place of flat washers but with the added feature of automatic compensation for wear or developed looseness in the assembly. Particularly suitable for use on wood or materials subject to shrinkage, also for wide clearance holes. Its tempered surface acts as a thrust bearing.

POSITIVE TYPE "D"—The barbs on the ends of this spring lock washer, under compression, embed themselves in the face of the nut, screw or bolt, and bolted surface, providing resistance to back turning.



NONLINK POSITIVE—A non-entangling spring lock washer combining the features of Kantlink and Positive types for use when these special features are needed.

SPRINGLOX—Permits the use of thinner more resilient steel sections, while providing greater reactive tension than available from identical size steel sections in the helical spring washer design. Also, does not dig in or serrate bolted surface; particularly suitable for aeronautical applications.



HY-PRESSURE HY-CROME—Possesses superior strength and provides reactive pressures considerably in excess of A.R.E.A. specifications, has superior reactive values for each bolt size.

Adapted from *Product Engineering*

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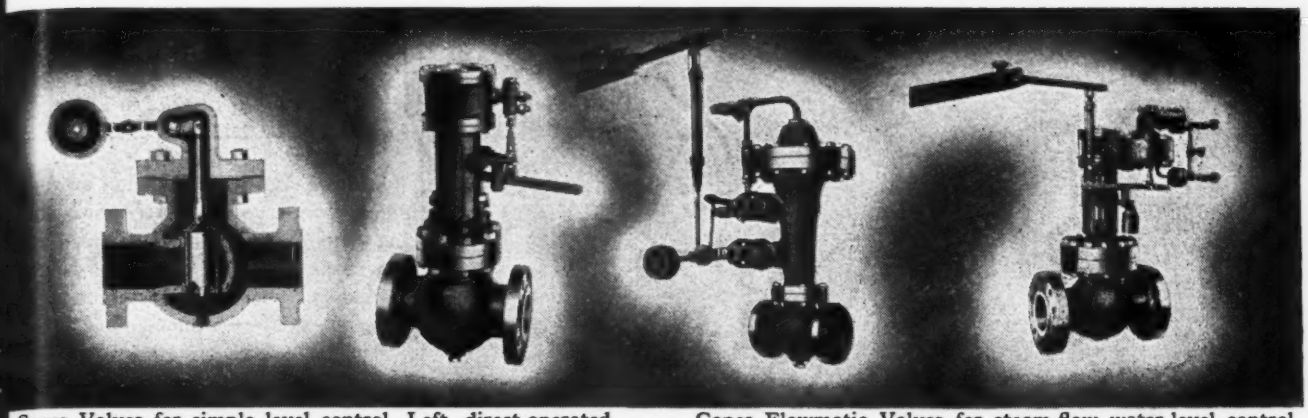

Copes Valves for simple level control. Left, direct-operated. Right, relay-operated.

Copes Flowmatic Valves for steam-flow water-level control. Left, direct-operated. Right, relay-operated.

NO FEED WATER REGULATOR IS BETTER THAN ITS——

PERFORMANCE of a feed water regulator depends largely upon the merits of its control valve. For the valve actually regulates the feed supply. It determines the flow characteristics obtained. It should be responsive to the slightest command of the actuating element. And it should function smoothly and reliably under difficult operating conditions.

That's why Copes Engineers have always emphasized valve design. Years of development and specialization in feed water control have fostered "know how" that we believe cannot be matched. There are several designs of Copes Valves for different classes of service, and to conform to various types of Copes Feed Water Regulators. All embody these valuable characteristics—(1) *Each valve is equipped with valve ports having correct flow characteristics for the job.* (2) *Port areas are designed for the specified maximum capacity.* (3) *Valve plunger has high lift—conducive to accurate control.* (4) *Scientific balancing and minimum friction assure sensitive response without "chatter" or "jumping."*

When purchasing feed water regulators, the soundness of Copes Valve design is an important reason why you should specify Copes. For other reasons write for Catalog 12–41.

NORTHERN EQUIPMENT CO • 451 Grove Drive, Erie, Pa.

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CONTROL VALVE

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This work leaves NO margin for error. The mud pump manifold above will go to jungle heart in a far land thousands of miles from point of manufacture. Should it function imperfectly operations would be held up for six irreplaceable months . . . Jobs like this are made for Associated. It is a privilege to handle so many of such critical character.

ASSOCIATED PIPING & ENGINEERING CO., Inc.
2332 East 38th Street • Los Angeles 11, California

Centrifugal Pumps

(*Continued from page* 118)

that designs of double-suction or multi-stage pumps particularly permit shifting of the impellers on the shaft to center them closely in their volutes. Radial-clearance leakage joints permit this, but axial clearance joints do not.

Q 20—*What is the most desirable clearance-ring construction?*

A—This varies with the kind of liquid handled, pressure across the leakage joint, rubbing speed between running and stationary clearance surfaces and pump design. Generally pumps have ring designs which their manufacturers have found best suited to the service for which the pump is used.

Q 21—*How are casing rings held in the casing?*

A—With axially split casings it is general practice to use a tongue-and-groove joint for the ring in the casing's lower half so that bolting the two casing halves firmly locks the ring in place and prevents it rotating. In radially split casing, casing rings are pressed into the casing or the stage piece and are frequently bolted in place.

Q 22—*How are impeller rings held on the impeller?*

A—They may be pressed or screwed on the impeller hub depending on pump design, intended service and the expected frequency of ring renewal. It is also general practice to hold impeller rings in place by set screws or other fastening devices. In some designs the impeller rings are shrunk onto the impeller, but this is restricted to materials which permit such an assembly.

Reader's Problems

(*Continued from page* 112)

must be a section of the heating system not under vacuum, but operates as an ordinary pressure system with vented radiators from which the trap delivers condensate to the vacuum return of the main system.

If the trap should leak or balance under above conditions, air would be drawn in at the vents, through the radiators and common return, and into the vacuum system. This would be possible

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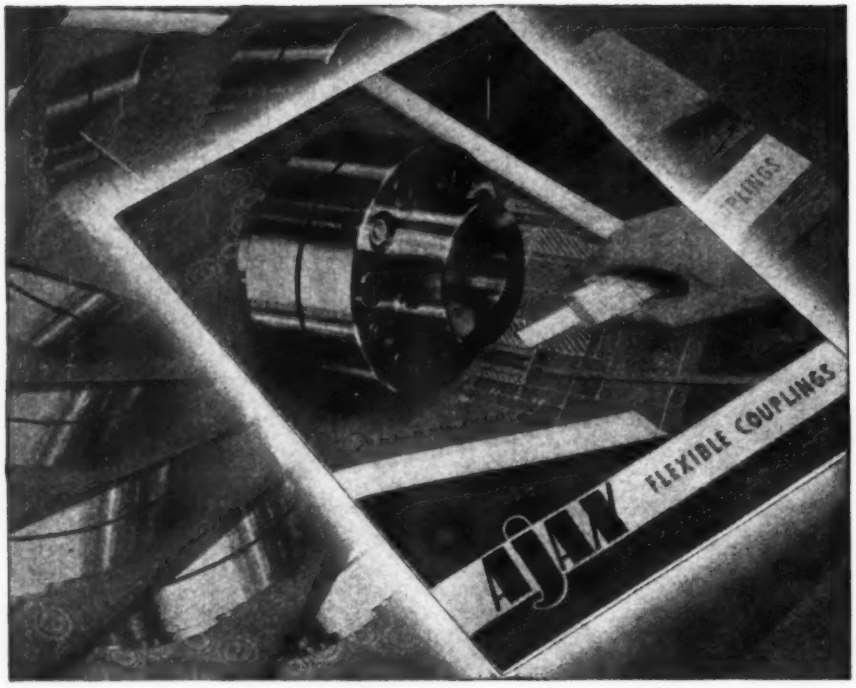
In spite of the production-line schedules necessary to meet war-time needs, precision marks every step in the production of Chapman Steel Valves. Metals are developed and produced in the Chapman foundries under strict metallurgical control and are selected to meet the exact requirements for which the valves are designed. Repeatedly checked during manufacture against high precision standards, each Chapman Steel Valve rolls off the line ready for dependable service under severest war-time conditions.

The CHAPMAN VALVE

Manufacturing Company

INDIAN ORCHARD, MASSACHUSETTS



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WESTFIELD, N. Y.

only if the steam pressure on the heating system were low, say 1 psi or less. But leakage through these vents would result in cold radiators, low vacuum and excessive running of the vacuum pump. EJ should put his system under low pressure and check for leaks before considering any radical changes.

Marissa, Ill. GEORGE HOLMAN

Check Pump Capacity

REMOVE AIR VALVES and replace with pipe plugs. Trap each radiator separately to the return. See that steam enters top of each radiator. Check all valves so that they are open or closed, as required. Determine whether pump capacity will take care of radiation.

Does condensate return to pump chamber too hot? If so, steam is leaking into the return, either from traps or a cross-connection (steam line connected into the return).

Test the pump alone to see whether it will pull a higher vacuum; follow instruction manual. Inspect strainer for scale and grease. Check strainer cover and suction-valve cover gaskets for leaks. See that air is not entering at packing glands.

Air may be entering the vacuum pump through its vent pipe causing it to run continuously. Remedy is to install a swing check valve on the end of the vent pipe to open outward.

Baltimore, Md. C D PRICE

Are Risers Waterlogged?

IN A VACUUM-HEATING SYSTEM do not use air vents on radiators. Also radiator valves should be packless as every packed valve stem is a possible air leak. Radiators should be individually trapped to keep steam out of return lines. Risers should usually be drained through a float trap and it is good practice to pitch horizontal runs toward nearest trap.

With thermostatic traps, clearance between valve and seat is usually so small that a slight deposit of sediment chokes the trap while with float traps the strainer must be watched. Keep them thoroughly clean. I have found a ⅛-in. pet cock on top of a float trap useful for venting air.

Lack of vacuum can be caused by: (1) air leakage (2) traps leaking steam (3) vacuum pump not functioning properly. No heat on upper floors can be caused by: (1) risers to upper floors waterlogged through lower-floor radiators (2) dirty traps on upper-floor radiators.

A vacuum of 2 in. is hardly enough but I am inclined to think that too high

Designed for longer life

TUBE-TURN welding fittings contribute to longer life for any piping system in which they are used—by their greater strength, their smooth walls of uniform thickness, and their resistance to wear and corrosion. Welded piping connections are permanently tight and leakproof, and the whole system becomes virtually a single pipe. Threading, caulking, gasket replacement and bolt tightening are eliminated, thus doing away with potential causes of trouble in systems where other type fittings are used.

Other Tube Turns advantages include lighter weight, greater efficiency of flow, more flexibility of layout. Because Tube-Turn welding fittings are stronger, they are safer. Maintenance costs are lower, insulation is easier. Specify Tube-Turn welding fittings for your next piping job, and reap the benefit of all these advantages.

For complete information on the superiority of Tube Turns' exclusive manufacturing methods and data on successful installations in many industries, write for Catalog 111.

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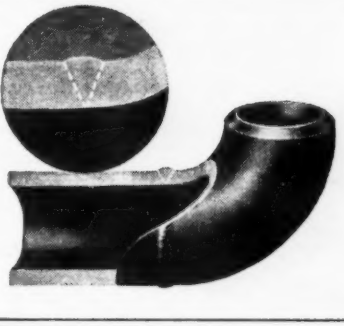
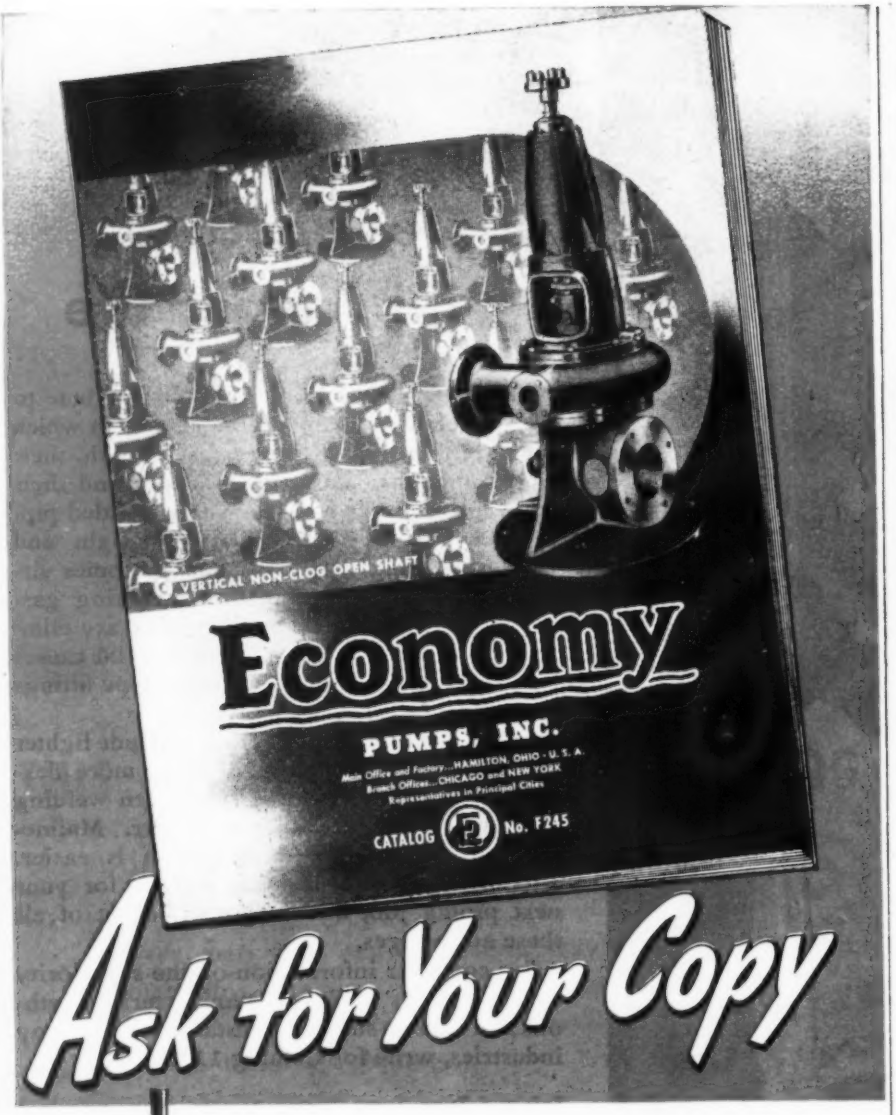
See how Tube-Turn welding, fitting and pipe are fused into one solid piece of metal. The welded joint is actually stronger than the pipe itself.



TUBE-TURN TRADE MARK *Welding Fittings and Flanges*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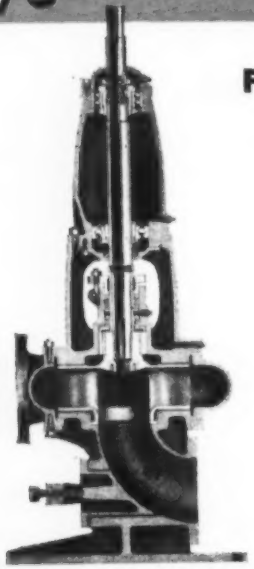

Cross Section view of Type SSV Pump showing Adjusting Nut for taking up Impeller wear, Bronze Renewable Shock Absorber and other exclusive features described in Cat. F-245.

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NOTE: There still are some valuable territories not under sales contract. Write for information on sales plan and distribution of Economy Pumps.

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a vacuum is not altogether desirable as you may have to resort to orifice plates to equalize distribution.

Thermostatic traps can be put in the wrong place. In one building inlet and outlet entered the radiators side by side on one end. When traps were installed and steam turned on, the traps shut off with radiators still cold. Connecting the trap and return line to opposite end of the radiator overcame this.

New York, N. Y. W H FRASER

Use Vacuum Air Valves

FOR BETTER RESULTS in a vacuum system replace automatic air vents with vacuum air valves that prevent air entering the radiator. Install thermostatic traps on each radiator; if risers and drip lines are to be trapped, locate the trap not less than 4 ft from the riser, main, or drip lines; otherwise, conduction of heat to the trap keeps it open.

Vacuum systems require tight piping for proper operation. The automatic controller may be set for vacuum wanted, normally from 3 to 20 in. at the pump. Negative pressure operates the controller, which is nothing but a diaphragm-operated steam valve.

Periodic inspection of thermostatic traps is best for good and economical operation. Where return lines are permitted to drain slowly, radiators give off less heat because condensate backs up in the system. For vacuum-return systems, return-line piping may be smaller than that regularly used on 2-pipe systems.

Fairview, N. J. M N GOZDENOVICH

Slope Radiators Properly

IF THE SYSTEM is to operate under vacuum remove the air vents. I prefer individual traps on each radiator with orifices installed where needed to secure even distribution of steam throughout the building. Where installed radiators are too large, time and fuel can be saved by using orifices on individual radiators instead of changing radiators or allowing the rooms to overheat.

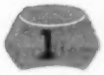
No heat on the upper floors of EJ's building can be caused by insufficient steam supply or air leaks in the system, or both. The small amount of vacuum seems to indicate leaks although it could be caused by traps on the lower levels allowing steam to pass through.

When operated below atmospheric pressure, air vents allow air to leak into the system to a point where air and steam pressures are balanced. With vents on the radiators the system must be supplied with steam above atmospheric pressure if all radiators get steam. Leaks and radiators that slope

BRANCH PIPE OUTLETS *in 4 Simple Steps*

Size-to-size or reducing sizes

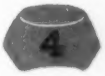
Installation of branch pipe outlets on the job or in the shop is quick and easy by the WeldOlet method. The inside of the WeldOlet serves as a template simplifying layout. It is not necessary to cut out a section of the run pipe or shape the end of the branch pipe. Check the following simple steps in installation.



LAYOUT—Locate WeldOlet on run pipe where outlet is to be made and mark center lines. Using inside of WeldOlet as template, mark hole to be cut in run pipe with scriber. Center punch along scriber mark to give definite cutting line.

CUT HOLE—Use torch for cutting hole in run pipe. Hold torch at right angles to pipe and follow center punch marks. Remove any icicles or beads with chisel.

TACK WELD—Re-position WeldOlet on run pipe with original center line marks. To get proper penetration of weld metal, separate fitting from main pipe 1/16" to 1/8" by inserting welding rod. Tack weld at 4 points.



WELD IN PLACE—Use either oxy-acetylene or electric arc welding for satisfactory results. Lay down a bead in the bevel between WeldOlet and main pipe. Completely fill bevel at base of fitting with weld metal to obtain a leakproof joint of full, original pipe strength.

REDUCING SIZE—Inserting spacers between WeldOlet and run pipe before tack welding to insure full penetration of weld metal.

SIZE-TO-SIZE—WeldOlet with 6" outlet being welded to 6" pipe. To obtain full pipe strength completely fill bevel with weld metal.

After the WeldOlet is installed, an inspection of the inside of the joint can readily be made so that if any icicles or beads have formed, they can be removed. You are now ready to connect the branch pipe. WeldOlets are available with three types of outlets—threaded, welded or socket—depending on the needs of the job. For full information on WeldOlet installation, write for the Handbook of Branch Pipe Outlets.

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WELDING OUTLET - THREADED OUTLET - SOCKET OUTLET
For Welded Branch Pipe Outlets

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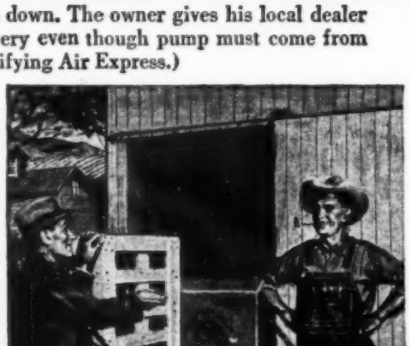
WATER PUMP on Wisconsin dairy farm breaks down. The owner gives his local dealer a hurry-up call. Dealer promises quick delivery even though pump must come from Cleveland. (He has it in the morning by specifying Air Express.)

DEALER ABSORBS Air Express charges but, even so, he figures a saving of money — because the pump is a high-priced, slow-turn unit that he cannot afford to stock. (With Air Express the nation's inventory is within hours of your business.)



THOUSANDS of businessmen find this fastest delivery a real economy — *a real money-maker* — when a customer wants something not in stock. (Yes, with Air Express, you give high-speed service on high-priced items without cost of stocking.)

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toward the supply line instead of toward the return are two things most likely to cause trouble in a changed-over system. In a 2-pipe system with vacuum return, small leaks must be repaired to prevent air entering the system.

Check piping and radiators for water pockets. If the plant uses exhaust steam from reciprocating engines or pumps there may be some trouble with oil and rust plugging the thermostatic traps.

Sources of trouble in a vacuum-return system, are: (1) leaks (2) thermostatic traps out of order (3) water pockets in pipes and radiators, especially at the bottom of risers (4) high-pressure traps discharging into the return lines (5) too small pressure differential between supply and return.

Lombard, Ill. H D BROWN

Low Vacuum Is the Cause of Poor Heating

CORRECT THE TROUBLE by removing air vents and fitting each radiator with an individual trap. Reason for no heat on upper floors with a vacuum-heating system is usually too low vacuum caused by leaking valve stuffing boxes, joints or traps.

If supply line has no orifices, and you connect several radiators to one trap, especially a thermostatic type, the radiator nearest the supply, or one that does not condense steam so fast will close the trap and thus prevent the other radiators working.

Bronx, N. Y. GEORGE GRIFFEL

Engineer's Bookshelf

(*Continued from page* 124)

The last two decades have witnessed the greatest construction of dams in world history. Many of the mightiest dams have been designed and constructed—Grand Coulee, Boulder, Shasta and Fort Peck, to mention only a few. This period also saw, constructed on the Tennessee River, the greatest system of dams ever built. Other great dams and systems of dams are planned for postwar construction.

This increased interest in dams has intensified experimental research and a re-examination not only of details and methods of construction but also of many of the theories of design, all of which have resulted in a substantial improvement in the art and science of dam building. It is for this reason that the authors present this comprehensive work to serve practicing engineers and engineering students.

Most comprehensive treatment ever published on dams, these books represent not only the thinking of the authors, all of

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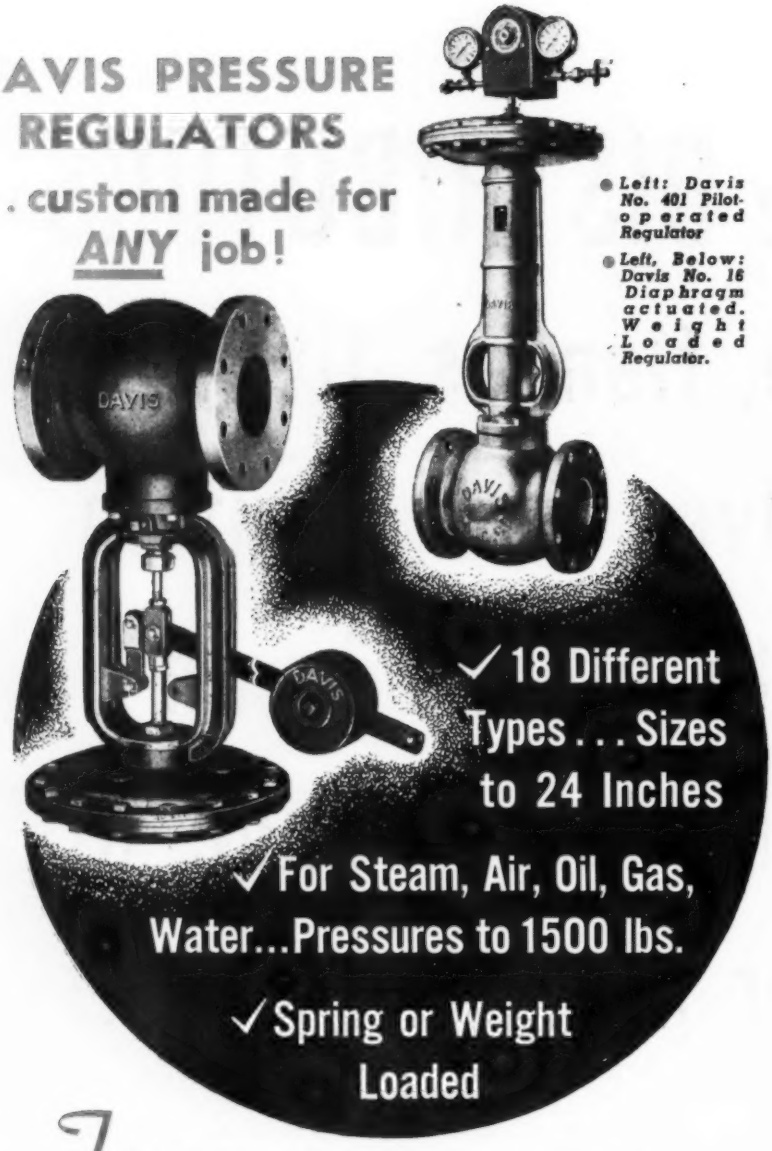

● *Left: Davis No. 401 Pilot-operated Regulator*

● *Left, Below: Davis No. 16 Diaphragm actuated, Weight Loaded Regulator.*

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✓ For Steam, Air, Oil, Gas, Water...Pressures to 1500 lbs.

✓ Spring or Weight Loaded

TO obtain maximum efficiency in your pressure regulator installation, it is absolutely essential to have the proper valve for each application. Pressure reduction requirements are as dissimilar as finger prints, and solution of these often-complex problems requires proper size, capacity and operating characteristics, as well as proper design and dependable construction.

The Davis Pressure Regulator line is COMPLETE; no matter how special the application, Davis builds a regulator that will do the job. Every Davis product is constructed and tested to meet the requirements of each individual order.

Davis engineers can solve your pressure reduction problem quickly and efficiently. Literature and selection charts prepared in easy-to-use form are yours for the asking.

For additional information, write today for Bulletin 100 A.

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DAVIS REGULATOR COMPANY

whom have had long experience in dam design and construction, but also that of six contributors who are outstanding authorities.

Vol I covers investigation of dam sites, choice of type of dam, preparation and protection of the foundation, hydraulic model studies, flood flows and spillways; vol II, forces acting on dams, requirements for stability of gravity dams, general procedure for the design of gravity dams, design of solid nonoverflow gravity dams, design of solid spillway gravity dams, internal stresses and stress concentration in gravity dams, arch dams, buttress concrete dams, concrete for concrete dams; vol III, soil tests and their utilization, earth dams—general principles of design, stability of earth dams, details of earth dams, rock-fill dams, steel dams, timber dams, details and accessories and headwater control.

The many tables are valuable. One gives a record of over 800 floods in the United States and 30 in foreign countries. Another lists 36 items of data on 38 arch dams, another tabulates information on 75 earth dams, and equally comprehensive information is given on other types of dams. The authors, as practicing engineers and writers of wide experience, have put into these books the information required in the practical design of dams, so that it can be most readily applied. A 38-page index and bibliographies of practically every information source add much to the books.

ELECTRIC POWER DISTRIBUTION FOR INDUSTRIAL PLANTS (1945) *Developed by AIEE Committee on Industrial Power Applications. Published by American Institute of Electrical Engineers, 33 W 39 St, New York, N. Y. 109 pp, 7½x11 in., 58 illustrations, 26 tables, stiff-paper binding.* $1.00

Over 40 contributing authors, who are electrical engineers with industrial and public-utility companies, prepared this report. Represented are the aircraft, automobile, cable, chemical, copper, electrical-equipment, factory insurance, mining, oil, photographic, rubber, steel and public-utility industries.

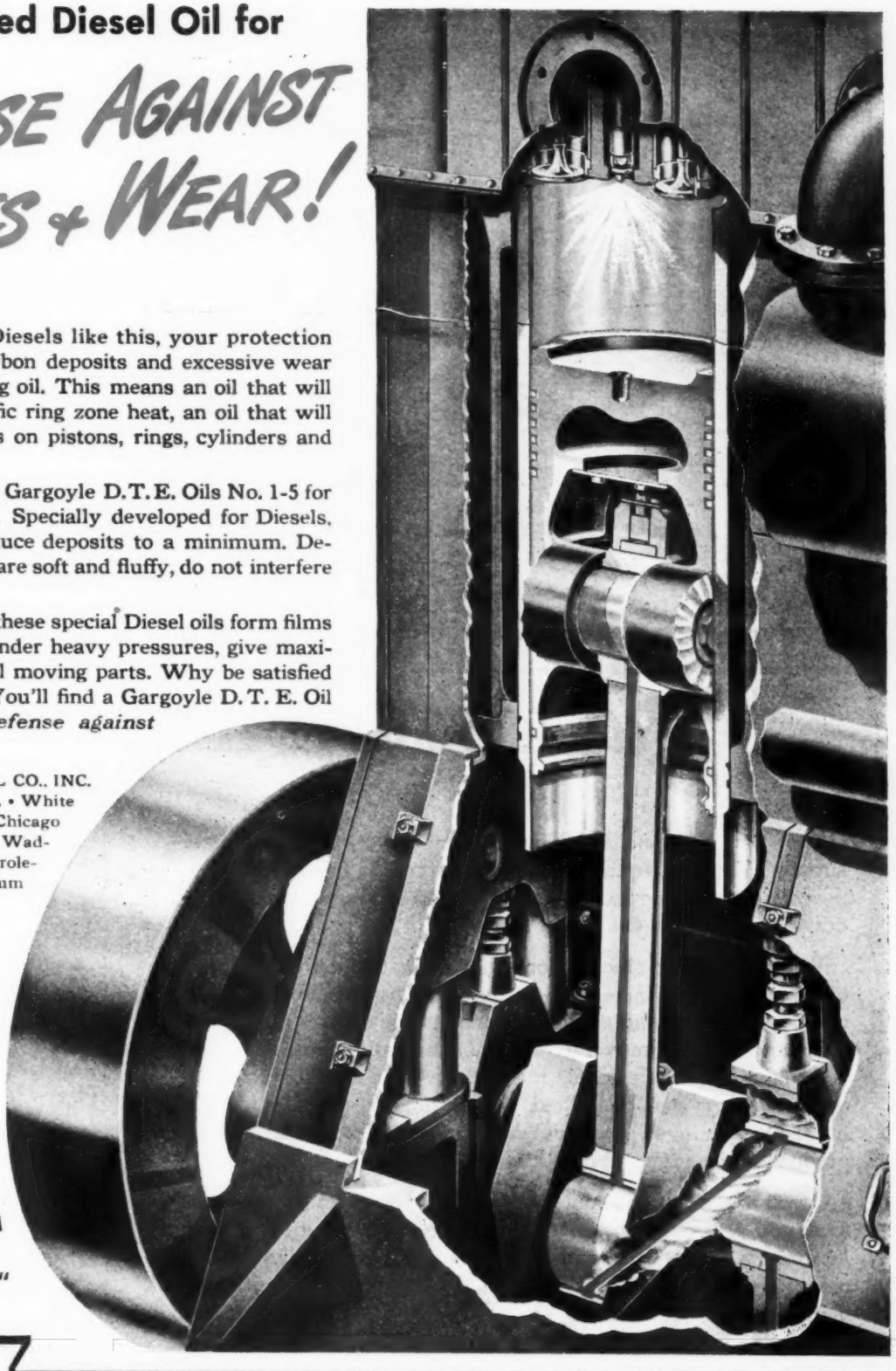
The report outlines sound engineering principles of distributing power to industrial plants. It analyzes service requirements, voltage-regulation problems, load and distribution characteristics and deals with the selection of equipment for distribution systems. Operating and maintenance problems are considered in so far as they affect the system and equipment selection.

The report is divided into seven sections: (1) system planning (2) primary substations and feeders (3) transformers, primary switchgear and low-voltage feeder protection (4) low-voltage feeders, panelboards, bus distribution systems and load circuits (5) safety (6) fault-current calculations (7) wires and cables. Treatment is highly practical and the many tables of useful data and charts on distribution system calculations make this report of interest to everyone that has to do with distribution system problems.

THE PIPE FITTER'S AND PIPE WELDER'S HANDBOOK (1944) *By Thomas W Frankland, instructor, Washburne Trade School.*

Use a Proved Diesel Oil for

DEFENSE AGAINST DEPOSITS + WEAR!



DEEP inside big Diesels like this, your protection against hard carbon deposits and excessive wear is the right lubricating oil. This means an oil that will stand up under terrific ring zone heat, an oil that will maintain strong films on pistons, rings, cylinders and bearings.

You can depend on Gargoyle D.T.E. Oils No. 1-5 for this double-duty job. Specially developed for Diesels, these famous oils reduce deposits to a minimum. Deposits that may form are soft and fluffy, do not interfere with ring operation.

Just as important, these special Diesel oils form films that resist rupture under heavy pressures, give maximum protection to all moving parts. Why be satisfied with anything less? You'll find a Gargoyle D. T. E. Oil No. 1-5 the *best defense against deposits and wear.*

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SOCONY-VACUUM'S 5 Steps to Lower Production Costs:

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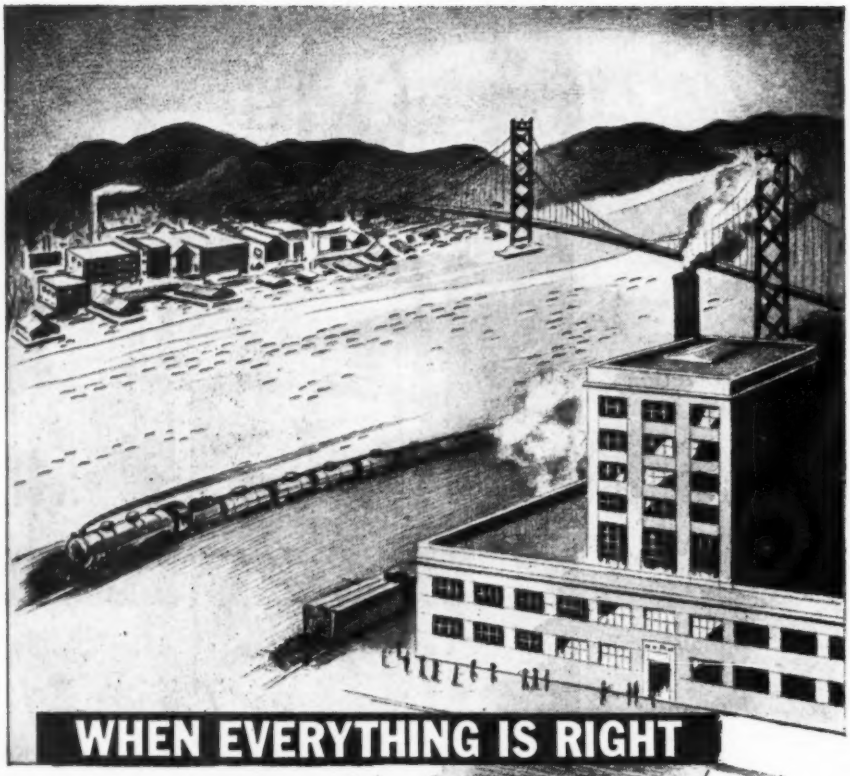

WHEN EVERYTHING IS RIGHT

But THE WATER SUPPLY

Often a new plant site is ideal from every angle—except the water supply. Whether required for cooling, process or drinking purposes, however, the bacterial quality of the *raw water* need not occasion abandonment of the location.

W&T engineered chlorination is demonstrating daily that objectional microorganisms—slime forms, iron bacteria, pathogens—can be destroyed, and their recurrence in the system prevented, economically and conveniently. The generally low and finely controlled chlorine residuals required have no deleterious effect on the water system itself, and, when properly specified, do not interfere with even such delicate chemical processes as the production of today's synthetics.

If you are in doubt about the water supply at a new location, or *if you are experiencing biofouling troubles at your present location,* Wallace & Tiernan Engineers will gladly make recommendations from their broad experience in industrial water treatment.

CD-13

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Manufacturers of Chlorine and Ammonia Control Apparatus

Belleville 9, New Jersey **Represented in Principal Cities**

Published by The Bruce Pub Co, 540 N Milwaukee St, Milwaukee 1, Wis. 152 pp, 3¾x5 in., 62 illustrations. $1.25.

Beginning with a chapter on basic mathematics, the author explains how to figure the area and volume of different-shaped objects and lay out angles with 2- and 6-ft rules. Simplified illustrations together with the necessary formulas show how to lay out piping offsets with angle fittings.

Considerable space is devoted to laying out curved pipe lines, angle branches and reducer fittings for welded construction. More than 41 pages of functional tables make this book a handy pocket manual for mechanics.

THE STEAM BOILER YEARBOOK AND MANUAL (1945) *3rd edition. Pub by Paul Elek, Ltd, Africa House, Kingsway, London, WC2, England. 557 pp, 5½x8½, illustrated, cloth; 30 shillings (about* $7.50).

Following the policy of previous editions, first part of the book reviews current practice in steam-boiler engineering, while the second part summarizes the principal steam-boiler papers published during 1944.

Part I now consists of 25 chapters, of which six are entirely new. Part II is made up of five long chapters dealing with fuel utilization, combustion appliance developments, feedwater and steam problems, "fireside" problems, modern practice and developments.

Containing a wealth of drawings and detailed data, which include inserted advertisements, this volume is of tremendous value to British readers. The information should also be helpful to American readers, but less so than to British because most of the hundreds of equipment items pictured are specifically British.

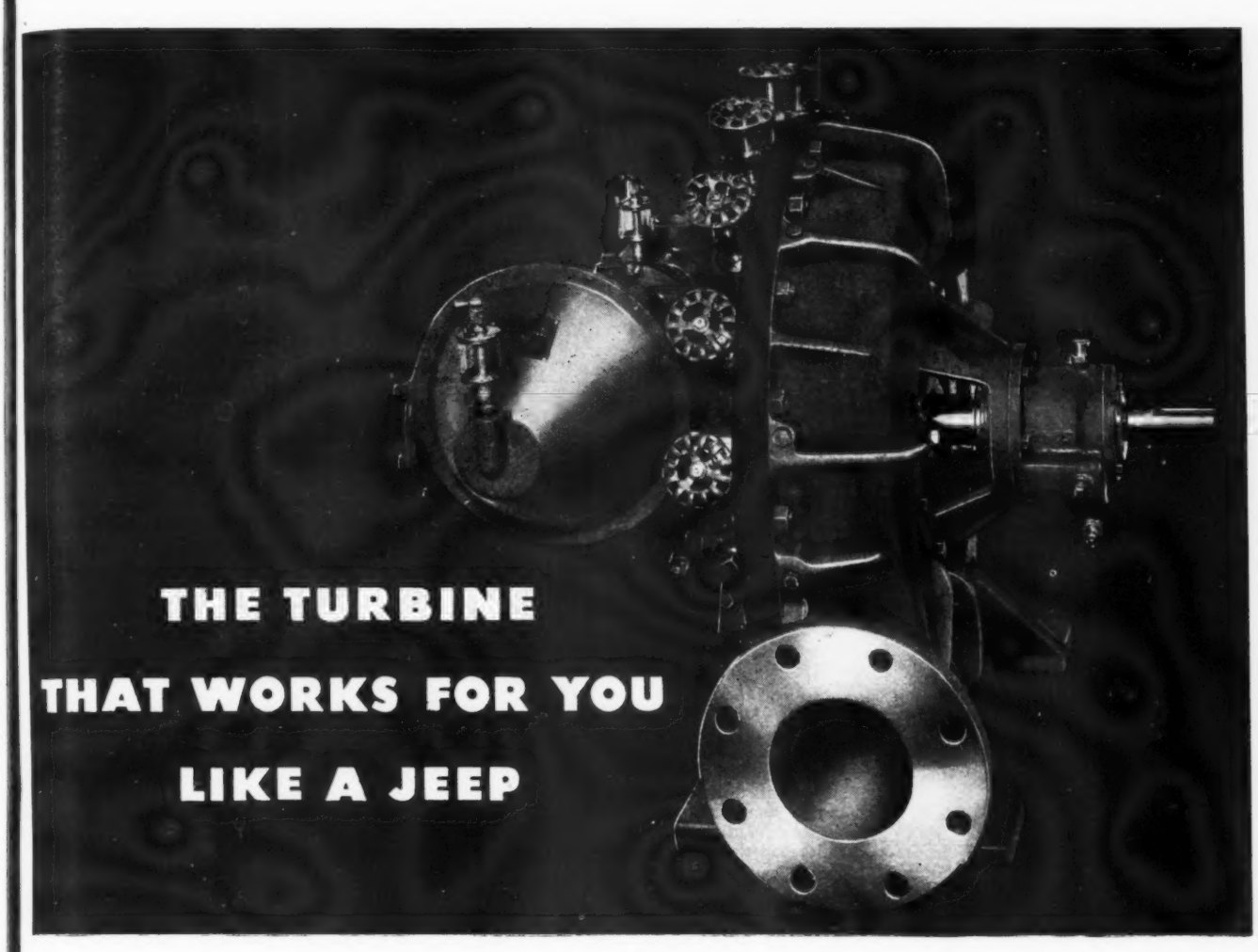
ASTM STANDARDS (1944) *Published by the American Society for Testing Materials, 260S Broad St, Philadelphia 2, Pa. Three vol, 1235 specifications and standard methods, more than 6000 pp;* $10 *each vol* (1944), *supplements as issued* $4 *each vol each year.*

Complete revision of formal, tentative and emergency standards and alternate provisions for metallic and nonmetallic materials. Vol I: Metals, 225 specifications for ferrous metals (steel, cast iron, alloys, etc), 160 for nonferrous (aluminum, copper, magnesium, lead, nickel alloys, etc). Vol II: Nonmetallic, constructional, 447 specifications and tests on cement, brick, tile, concrete, paints, insulation, etc. Vol III: Nonmetallic materials, general, 440 specifications and tests for plastics, soaps, coal, petroleum fuels and lubricants, electrical insulation, hose, belting, water analysis, etc. Each volume may be purchased separately.

CORRECTION

Inadvertently the name of the publisher of "Prodigal Genius, The Life of Nikola Tesla" was omitted from the book's review in Jan, 1945, POWER, page 128. The publisher is Ives Washburn, Inc, 29 W 57th St, New York 19, N. Y.

(*Continued on page* 148)



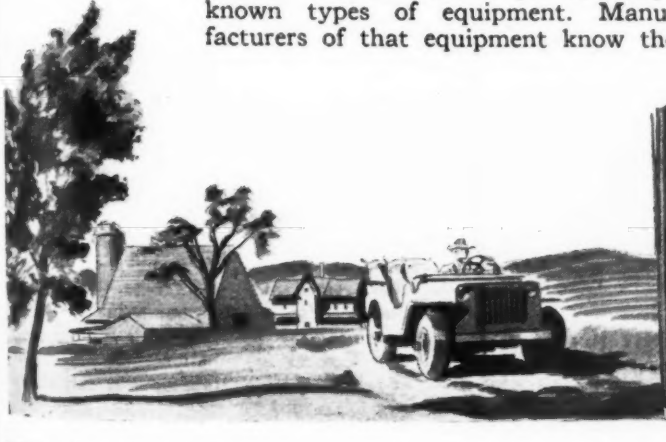
Small, but powerful . . . like a jeep. That's the Coppus Steam Turbine that you see around so many places powering pumps, blowers, fans, stokers and other equipment requiring a steady, sturdy source of small HP.

The Coppus line of "Blue Ribbon" turbines runs from 150 HP down to fractional — there are six frame sizes, and prices are in proportion. You can match a Coppus turbine to the job, saving the money you might otherwise spend for a turbine that's larger than necessary.

You'll see Coppus "Blue Ribbon" Steam Turbines on many nationally-known types of equipment. Manufacturers of that equipment know the quality that is represented by the Coppus "Blue Ribbon" — more than 85% of all orders since 1937 has been repeat business.

Select the right size of Coppus turbine for any job that calls for "jeep duty". Like all Coppus "Blue Ribbon" products (blowers, ventilators, gas burners, etc.), they are made to extremely close tolerances with accuracy controlled by Johansson size blanks. Before shipment, every turbine is dynamometer-tested.

Write for Bulletin 135–10. Coppus Engineering Corporation, Park Avenue, Worcester 2, Mass. Sales offices in THOMAS' REGISTER. Other Coppus "Blue Ribbon" products in SWEET'S.



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High grade gas, by-product, steam and domestic coal from Wise County, Va., on the Interstate Railroad.

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High grade, high volatile steam and by-product coal from Wise County, Va., on the Interstate Railroad.

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A laboratory controlled product blended to meet exacting stoker requirements. From Wise County, Va., on the Interstate Railroad.

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Roda and Stonega from Wise County, Va., and Connellsville Coke from Pennsylvania.

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High grade gas, by-product, steam and domestic coal—Pittsburgh seam from Irwin Basin, Westmoreland County, Pennsylvania, on the Penna. Railroad.

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Genuine Third Vein Pocahontas from McDowell County, W. Va., on the Norfolk & Western Railroad.

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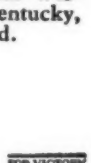

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BOOKLETS

How to Run a Lathe *Pub by South Bend Lathe Works, 373 E Madison St, South Bend 22, Ind. 128 pp, illustrated, 25¢ with paper cover and 75¢ with leatherette cover.* This book contains the latest information on operation and care of metal-working lathes. A number of changes in text material and illustrations have been made since the 1942 edition was printed. It covers such subjects as operation of lathe units, grinding cutter bits, accurate measurements, plain turning, chuck work, taper turning, boring, drilling, reaming, tapping, cutting screw threads, reference tables, etc.

Technical Manual on Industry Standards, Recommended Practices and Technical Information *By Engineering and Research Committee, Stoker Manufacturers' Association, 307 N Michigan Ave, Chicago 1, Ill. 60 pp, paper bound, $1 each up to ten copies, 85¢ each for 10 to 50 copies, 75¢ each for over 50 copies. Association, however, will furnish single copies free to registered architects, consulting engineers, home builders and other professional men engaged in engineering and design work on homes, buildings, boilers, furnaces and equipment related to automatic and mechanical stokers. Such requests must be on individual or firm letterhead.* The manual makes available stoker data for selection, sizing and application of stoker equipment to various furnaces and boilers and heating loads. It has eight sections: (1) glossary of terms (2) selection factors (3) condensed table (4) standard codes and recommendations (5) chimney data (6) stoker nomenclature (7) coal data (8) miscellaneous.

Consolidated Table—Load Carrying Capacities; Minimum Furnace Dimensions; Draft and Chimneys for Typical Single Retort Underfeed Stokers: Explanatory Notes *Available from Stoker Manufacturers' Association 307 N Michigan Ave, Chicago 1; 4 pp; at 5¢ per copy. Lower prices are obtainable in quantity lots.* Folder contains a consolidated table on factors for selection of stoker equipment as reprinted from the Technical Manual. This table includes stoker load-carrying capacities, setting heights, boiler and furnace minimum widths and lengths, chimney sizes.

Personnel Problems of the Postwar Transition Period *By Charles A Myers for Committee for Economic Development, 285 Madison Ave, New York City, 60 pp.* Booklet discusses problems that may arise regardless of magnitude of layoffs and reemployment. It also helps to analyze present work force and to estimate postwar labor supply and requirements.

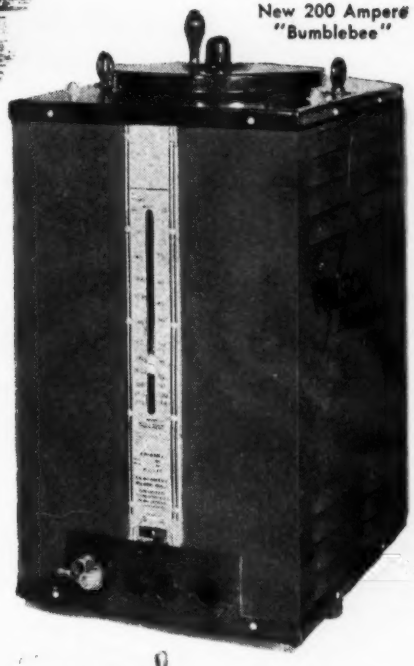
Veteran Re-Employment Program *Available from Summerill Tubing Co, Bridgeport, Pa., 24 pp.* This manual outlines plans and methods of re-employing men as they return from military to civil life. Summerill's 7-point program includes (1) reception (2) interview and reintegration (3) medical examination (4) placement (5) organization training (6) transfers (7) follow up.

NOW YOU CAN HAVE

"Bumblebee" performance

for every welding job

New 200 Ampere "Bumblebee"



WHATEVER your welding problem — on production lines, or special jobs — there's a Wilson "Bumblebee" A.C. Arc Welder that's just suited to your needs . . . designed to do the work faster, better, with lower power consumption.

"Bumblebees" are now made in five sizes, all embodying characteristic "Bumblebee" efficiency, economy and dependability: (1) The *new* 200 ampere "Bumblebee" for light, odd-job or production welding; (2) the 300 ampere, and (3) the 500 ampere "Bumblebee" for heavy all-purpose assignments; and (4 and 5) the 750 and 1000 ampere sizes available on special order. The 300 and 500 ampere sizes are available in "All-Weather" models for welding under conditions where excessive moisture is encountered.

Throughout industry the many important features of the "Bumblebee" have made them a widespread choice among owners and operators. With their deep penetrating arc and excellent arc characteristics, they permit more welding production per work day — of better quality, with considerably lower power costs.

Light, well balanced, rugged, they provide continuous, step-less current control, from maximum to minimum—simply by turning a crank on top. All "live" parts are completely shielded and protected.

All-Weather Model

300 and 500 Ampere Sizes

• See your nearest Airco office for full information or write Dept. P for catalog. Address Air Reduction, General Offices: 60 East 42nd Street, New York 17, N.Y. In Texas, Magnolia Airco Gas Products Co., General Offices: Houston 1, Texas.

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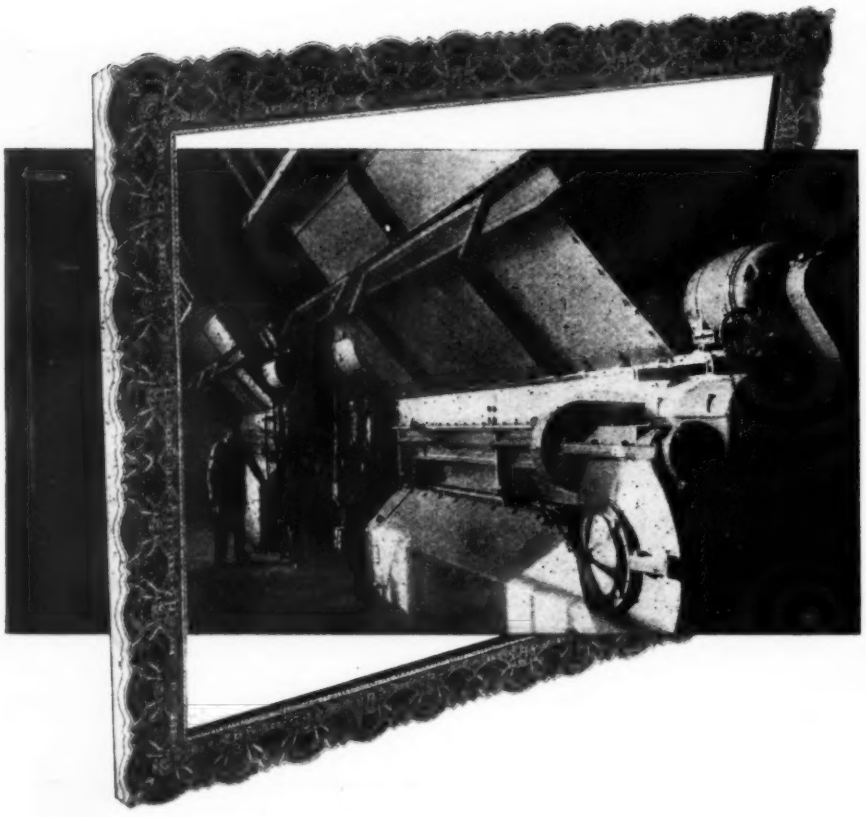
"Bumblebee"

A.C. **ARC WELDERS**

with the penetrating, stinging arc

A COMPLETE LINE OF A.C., D.C. AND GAS-ENGINE DRIVEN UNITS



...insurance against
OXYGEN CORROSION
in your boilers

Thirty parts of Santosite to a million parts of water in the boiler provides positive protection against expensive and exasperating shutdowns due to oxygen corrosion.

Experience has proved that Santosite is a valuable adjunct to mechanical deaeration. Its use is insurance against damage caused from leakage, overloads, trouble in auxiliary equipment and the traces of oxygen not eliminated by mechanical deaeration.

Cost of continuous Santosite treatment is insignificant: $0.05 to $0.65 per million pounds of boiler feed, depending upon the oxygen content of the water . . . and no special or added equipment is required to use Santosite.

Santosite, a stable crystalline anhydrous product, eliminates oxygen by combining with it to form sodium sulfate. Since both sodium sulfate and Santosite are soluble in water, neither forms objectionable sludge.

For complete details on the application of Santosite to your boiler feed water, write, wire or phone: MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second St., St. Louis 4, Missouri. District Offices: New York, Chicago, Boston, Detroit, Charlotte, Birmingham, Los Angeles, San Francisco, Seattle, Montreal, Toronto.

MONSANTO
CHEMICALS
SERVING INDUSTRY...WHICH SERVES MANKIND

Turbine Power

(*Continued from page* 98)

ion at reversing-turbine side of unit, a quill shaft extending through the pinion.

Each of four 3-in. inlet pipes connects to a nozzle group covering about 25% of the peripheral area of Curtis-stage blading and to a throttle valve and steam header located at smokebox top. Four cam-operated valves control steam to forward turbine; cams are arranged to open in sequence at small increments to provide close regulation of locomotive power and speed.

The reverse turbine, a single Curtis stage, overhangs on an extension of the reverse-gear pinion shaft. Steam is admitted to nozzles in both base and cover through a single inlet pipe, connected to the reverse throttle valve, also cam-operated and located adjacent to forward-turbine valves. Maximum locomotive speed in reverse is 22 mph. at which speed turbine develops 1500 hp.

A hydraulically actuated positive-engagement clutch transmits reverse turbine power to the main-gear speed pinion, to which forward turbine connects solidly. Engagement or disengagement of clutch when locomotive is moving is prevented by a zero-speed interlock in the Westinghouse Air Brake Co pneumatic-control circuit.

The main double-reduction gear transmits power to No. 2 and 3 driving axles from the single high-speed pinion. equal torque at each driver being assured by side rods connecting four driving wheels on each side. The nested gear consists of two double-helical high-speed gears, two low-speed spur pinions. two low-speed spur gears and two cup-drive elements, all inclosed in a fabricated-steel case. Representing a major advance, method of grinding double-helical gearing with extreme accuracy uses a flat wheel in combination with a novel grinding rig designed and developed by the Westinghouse steam division. The first-reduction gears are hobbed from material nearly twice the hardness commonly used.

Tin-base babbitt lines the high-speed pinion and gear bearings. High rubbing velocity at high-speed-pinion bearings required greater than usual clearances. High-speed-gear bearings rotate with pinion and gear, being fitted into hollow-bored low-speed pinions on which first-reduction gears are shrunk. Bearings rotate on trunnions which canter second-reduction pinions. Low-speed gears have anti-friction bearings.

(*Continued on page* 154)

LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . . LUBRICATION ENGINEERING . . .

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One oil . . . with many uses . . . that does each job better

STANOIL

STANOIL was developed to make it possible for you to use one or two grades of the *same* oil on many types of lubricating jobs in place of *many* special oils—one type for each job. Such an oil offers these advantages:

1. Simplifies lubricant stocks—which may mean fewer containers and dispensers—requiring less storage space—less clerical work in ordering lubricants and maintaining inventories.

2. Reduces possible confusion of lubricant application by reducing the number of brands of oil to be handled.

3. Makes possible the use of a higher grade lubricant throughout the plant.

4. Gives the cost advantage of large quantity buying.

Uses for Stanoil in plant lubrication have far exceeded those foreseen for it. Typical applications that have been made of Stanoil—and the improvement in operation it made—are briefly described here. There may be *many* operations in your plant where Stanoil will bring reduced maintenance and lubricating costs—plus the advantages listed.

A Standard Oil Lubrication Engineer will help you pick the jobs and apply Stanoil to simplify your lubrication. Write Standard Oil Company (Indiana) office, 910 South Michigan Avenue, Chicago 80, Illinois, for the Engineer nearest you.

Engine oil in a high speed steam engine in a Missouri plant emulsified badly and foamed because of the moisture escaping along the rod. The high demulsibility of Stanoil eliminated the emulsion and foaming.

Rotary compressor blade breakage was troublesome in an Indiana plant. When the battery of compressors was switched to Stanoil, wear was reduced, resulting in the complete elimination of breakage.

Hydraulic system in a shaper. The higher stability of Stanoil in the hydraulic system of a machine tool shaper reduced oil changes, provided better lubrication, and resulted in a 30% savings in lubrication costs.

Homogenizers in a food plant required an oil-change once a week in the oil-operated system of pumps and plungers. With Stanoil, oil-change periods were increased to once a month because of its higher stability and long-lasting quality.

Gasoline Powers the Attack . . . Don't Waste a Drop!

STANDARD OIL COMPANY (INDIANA)

STANDARD SERVICE

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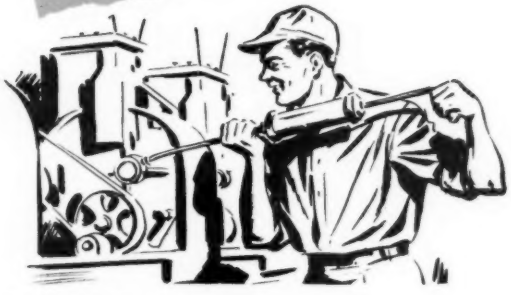
For easier handling in grease guns . . . longer life in anti-friction bearings



• THOSE TWO ADVANTAGES—easier handling, longer life—can materially reduce lubricating cost on the many anti-friction bearings in motors and machines in your plant. Stanobar Grease is a newcomer in the Standard Oil line—developed during the war. It has been tried in the proving ground of severe wartime demands and has made good on every claim for it.

Stanobar Grease was specifically designed to provide the benefits listed at the right. A Standard Oil Lubrication Engineer will be glad to help you put these cost-reducing qualities of Stanobar to work on your equipment. Write Standard Oil Company (Indiana), 910 South Michigan Ave., Chicago 80, Illinois, for the Engineer nearest you.

Easier handling in grease guns and central lubricating systems is the result of the smooth (non-fibrous) structure of Stanobar. Two grades—Stanobar No. 2 for grease gun or hand-packing applications, and Stanobar "S," a soft consistency for volume dispensing in central lubricating systems—meet practically all anti-friction bearing requirements.

Longer lasting quality in Stanobar is obtained by the use of a special inhibitor which prevents oxidation. This means longer periods of operation between filling or cleaning and packing bearings.

Greater resistance to thinning out when "worked" in bearings reduces the possibility of leakage and may also permit the use of one grade of Stanobar in place of three or four greases now needed for various plant requirements.

Easy application is an advantage of Stanobar which is unusual in many greases suitable for high temperature service.

Buy more War Bonds

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STANDARD SERVICE

★ LUBRICATION ENGINEERING

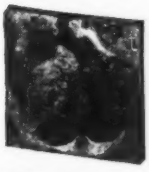
'This test proves I have a high Rust I.Q.*!"

**Inhibitive Quality*

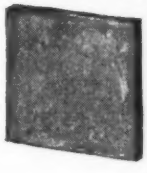
EAGLE SUPER "66" PLASTIC INSULATION

Here's proof from the laboratory!

Shown below are unretouched photos of two steel blocks used to test the rust-inhibitive properties of Eagle Super "66".



Here is how one block looked after being imbedded in a regular insulating cement for the test period. Note the heavy coating of rust. Such corrosion also occurs on iron and steel equipment, whether heated or cold.



This is how the other block looked after being imbedded in Eagle Super "66" for the same test period. Note how free of rust it is. The rust-inhibiting properties of Eagle Super "66" will protect *your* heated equipment just as effectively!

"Springy Ball" structure gives high insulating efficiency

Eagle Super "66" does a tremendously efficient job of insulating because it's filled with "springy ball" pellets of Eagle Mineral Wool. Each pellet contains thousands of tiny dead air cells which impart extremely low thermal conductivity.

This unique plastic insulation withstands a full range of temperatures up to 1800° F., and, if not used at temperatures above 1200° F., can be *removed, remixed, and reused!* Eagle Super "66" applies easily and quickly to almost any shape or size surface. Exceptionally high dry coverage gives lower cost per square foot than most insulating cements or blocks.

Data sheets with complete technical information are available on request.

FREE Manual! Gives case examples of how industrial insulation effects large fuel savings. Includes Heat Loss Estimate Sheet for your use. Write for your copy.

Back the boys at the front with MORE War Bonds.

Other Eagle Industrial Insulations Include:

Eagle Insulseal. A protective coating for insulation. Trowels on—dries to a hard finish. Withstands up to 450° F.

Eagle Swetchek (black). A prepared, asphaltic base, rust-inhibitive anti-condensation compound.

Eagle Drycote (white). A dry, ready-to-mix, rust-inhibitive anti-condensation compound.

Eagle "43" Finishing Cement. A hard white finish coating for all types of indoor insulation within a range from 70° F. to 800° F.

EAGLE-PICHER INSULATIONS
High and Low Temperature

EAGLE EP PICHER

Made by THE EAGLE-PICHER LEAD COMPANY • CINCINNATI (1), OHIO

Eagle Super "66" Plastic Insulation • Eagle L-T and M-2 Felt • Eagle Supertemp Block • Eagle Blankets • Eagle Pipe Covering
Eagle Insulseal • Eagle Loose Wool • Eagle Insulstic • Eagle Swetchek • Eagle Drycote

For V-DAY BUILDING

BENEFIT BY CONNERY V-STIFFENED NON-BUCKLING LEAKPROOF BREECHINGS . . . .

We take pardonable pride in the fact that 100% of Connery output is going to war production projects. And we feel certain that the many plants using (and planning to use) Connery's Improved Expansion Stiffened Construction for stacks, breechings, ducts, etc., won't mind if we give our best to "our first customer," Uncle Sam.

As government priority construction slackens, however, we will be in a position to offer old and new customers specific help on their problems of power plant construction.

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BREECHINGS
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UPTAKES
•
HOPPERS
•
AIR DUCTS

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INDIANAPOLIS POWER & LIGHT CO.	INDIANAPOLIS, IND.
CONSOLIDATED GAS ELEC. LIGHT & PR. CO.	BALTIMORE, MD.
VIRGINIA PUBLIC SERVICE CO.	ALEXANDRIA, VA.
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CONNERY CONSTRUCTION CO.
Second and Luzerne Sts. Philadelphia, Pa.

CONNERY
EXPANSION STIFFENED
CONSTRUCTION

The gear is split into four pieces. Center section forms the principal structural member to which forward turbine, reverse turbine and gear assembly are bolted. Upper section covers the high-speed gearing and contributes to crosswise stiffness of case. Two lower sections, removable to permit dropping the axles, form lubricating-oil sumps as well as inclosures for the low-speed gearing and cup-drive assemblies.

Since the complete propulsion unit is supported from the spring-borne locomotive frame, No. 2 and 3 driving axles must move up and down with respect to the low-speed gears that surround them as the locomotive moves over the rails. The cup drive, which permits this motion, is really a misalignment coupling between the low-speed gear and the locomotive axle. This Class S-2 cup drive follows the same principle as those used on main-line electric locomotives but differs physically, because it must be located between the wheels.

Cup-Drive Design

The Class S-2 drive occupies the center of each low-speed gear, Fig. 4 and 5. The quill becomes two short seats on the gear center for roller bearings, which are carried in the main gear case. There are two rows of cup assemblies, with eight in each row. Since the quill cannot extend to the driving wheels, a drive spider is pressed on the locomotive axle, at its center, and the gear torque is transmitted by the cup assemblies to the arms of this spider.

The 2-piece cups have self-aligning inserts which distribute spring load over relatively large areas of contact with drive spider arms. The oil-tight cover plates keep the entire mechanism clean and well lubricated with a bath of heavy extreme-pressure lubricant.

The cup drives, in addition to permitting up-and-down motion of driving axles, are torsionally flexible, protecting gearing and turbines from shock loads. To avoid any tendency of one axle to hog load, side rods between No. 2 and 3 driving axles force equal division of power flow. All side rods are fully balanced so that dynamic augment inherent in reciprocating locomotives is eliminated.

High-grade turbine oil (500 SSU at 100 F) lubricates all turbine and gear bearings, and gear teeth. The system contains about 150 gal and the entire quantity is recirculated by one of two small turbine-driven Goulds pumps, one serving as standby. Oil pumped from gear case goes through a magnetic strainer and oil filter to a heat exchanger cooled by boiler feedwater and then to a distributing manifold equipped

I'M SUPER-7-STEEL--NEWEST AND STRONGEST MEMBER OF TEXROPE'S V-BELT FAMILY. EXTRA-HEAVY LOADS, FIXED CENTER DISTANCES ARE WHERE I SHINE.
MEET ALLIS-CHALMERS FAMOUS
V-Belt Family!
To lick each of your different belt problems, you'll be sure of finding the right belt in America's widest V-belt line... Allis-Chalmers' Texrope!

180° F IS JUST COMFORTABLY WARM FOR ME. ASK FOR HEAT-RESISTING SUPER-7 STANDARD BELT WHEN WORRIED ABOUT TEMPERATURE.
♪ Tune in the Boston Symphony, Blue Network, Saturday at 8:30 pm, EWT.

IT PAYS TO MAKE ALLIS-CHALMERS YOUR

V-BELT DRIVE HEADQUARTERS

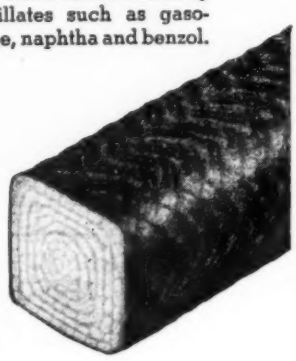
Texrope Super-7 V-Belts result from the cooperative research of two great companies—Allis-Chalmers and B. F. Goodrich—and are sold exclusively by A-C.

BELMONT PACKINGS

FOR GASOLINE SERVICE

← Belmont 6100

For rod and valve stems handling volatile distillates such as gasoline, kerosene, naphtha and benzol.



FOR HOT OIL SERVICE

Belmont 189 →

For rods and plungers handling hot or cold oil—all temperatures.

For OIL

PACKINGS are important in every plant production program. They keep the machines of industry turning—help speed from assembly lines America's weapons of war.

AND . . . now, when equipment must stand the strain of 24-hour-a-day operations—it's vitally important that just the right packings be selected for every job.

Above are two of the many Belmont Packings especially made for petroleum services. Both 6100 and 189 are made from asbestos yarn, braided and treated with suitable lubricants for maximum operating efficiency.

Any Belmont distributor (they are located in every large industrial center) will be glad to offer suggestions on your requirements. Or write on your company letterhead for a copy of the Belmont Packings Catalog displaying the complete Belmont Line.

THERE'S A BELMONT PACKING FOR EVERY SERVICE

Steam, Water, Oil, Gas, Air, Acids, Alkalies, Ammonia

Rings, Spirals, Coils, Reels, Spools, Sheets, Gaskets.

THE BELMONT PACKING & RUBBER COMPANY

BUTLER AND SEPVIVA STREETS • PHILADELPHIA 37, PA.

with a steam-heating coil before being piped to the bearings and gear sprays. A regulator maintains 15-psi oil pressure on bearings and sprays. The pump discharge is 60 psi, high-pressure being required for the hydraulic cylinder used to engage the reverse clutch.

A single lever at the right of the cab controls speed as well as direction. Motion forward from the neutral or off position controls steam flow to the forward turbine; motion backward from the off spot engages the reverse clutch and controls steam flow to reverse turbine. Speed control is by air-relay-controlled pneumatic cylinders which, through a rack and pinion forward and a lever reverse, rotate the throttle-valve cam shafts. If either turbine overspeeds or if lube-oil pressure falls below 5 psi the protection valves operate to close throttle by exhausting control air to atmosphere. Zero-speed interlock previously mentioned insures engaging clutch only when engine is not in motion.

Low Steam Cost

(*Continued from page* 102)

coals, yielding best performance on coals of relatively high ash-fusion temperature and low ash content. Spreader stokers burn the entire range from lignite to the highest rank bituminous, including high ash and low fusion. Pneumatic spreaders handle a size range from ⅛ in. to 0 or even 60-mesh coals as well as intermediate sizes up to 1½ in. Auxiliary power and maintenance requirements are usually low.

The foregoing backs up what every engineer should know—that coal characteristics differ widely and that he should select no fuel-burning equipment or heat-absorbing surfaces without a thorough survey of all coals presently and potentially available, giving special attention to sources and supplies of economy coals. General plant design and selection of firing and heat-absorbing equipment cannot be based on premium coals but must give full consideration to standard and economy coals to broaden potential coal sources and thus give the owner every possible economic advantage.

Too often, fuel surveys have suffered from incompleteness, recognizing only premium and standard coals. Operators can cut steam costs more sharply by advantageous purchases in plants designed for a wide coal range than is possible by gaining a few points in thermal

REGULATION...

" "I wanted a valve with a large capacity and close regulation. This valve is doing a fine job for us."

" "Our '1000' Streamliner regulates accurately and has required no attention whatever."

" "We wanted sensitive regulation and the Streamlined Valve gives it to us."

" "Our Maintenance Superintendent has often spoken about your '1000' valve and commented on how well it held its regulation."

" "My object in buying was for close pressure regulation, therefore I choose the LP1000 valve which is giving entire satisfaction."

" "We needed a valve able to handle a large demand and still give good regulation at all times. The '1000' is doing a fine job."

PERFORMANCE

" "We have had no maintenance whatever on these '1000' valves although there are a number of them installed."

" "Your valves have been very satisfactory. They have not required any attention."

" "I've never had to touch one of these '1000' valves after it was installed."

" "We have had your valves in operation for several years and have never required parts, diaphragms, or attention of any sort."

" "We continue to buy your '1000' valves because we must have equipment that requires little or no attention. Your '1000' valves fill the bill."

CASH STANDARD Streamlined PRESSURE REDUCING VALVE TYPE 1000

...and they all talk about these points too

SMOOTH OPERATION • TIGHT CLOSURE • ELIMINATION OF FAILURES • CONSTANT DELIVERY PRESSURE • NO SPOILAGE • SPEEDIER PRODUCTION RESULTS • COST-SAVING OPERATION

WRITE FOR BULLETIN "1000"

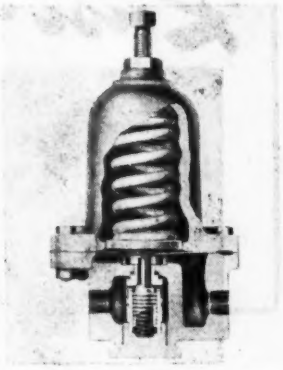
Straight Line Flow: steam, water, air, oil, etc. flow through this valve in a straight line—nothing is in the path of flow to cause turbulence—therefore, peak flow is never a problem.

Bulletin "1000" gives the details.

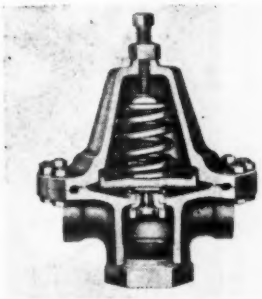
CASH STANDARD CONTROLS.. VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS

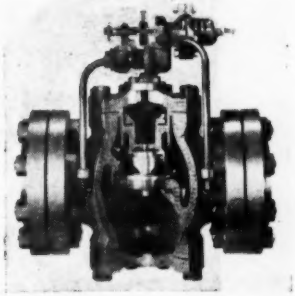
OTHER VALVES *from the* CASH STANDARD LINE



High Pressure Reducing Valve Type H-P; extra heavy for use with initial pressures up to 5000 lbs.; and for reduced pressures up to 650 lbs. Good for most fluids. Sizes: ⅜" to 2"; bronze body; nitralloy trim. Get Bulletin 931.



Type 8871 Pressure Regulator for dirty liquids (like Bunker C fuel oil). Inner valve is bolted to diaphragm for positive movement. Sizes ½" to 10". Bodies; iron, bronze, or steel. Seat ring and inner valve; stainless steel. Bulletin 972.

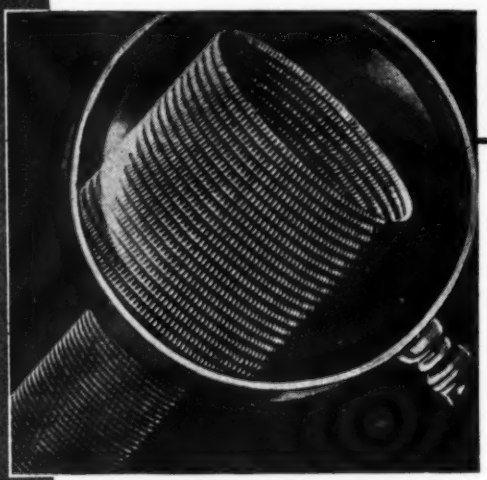


Cash Standard Type 10 Pressure Regulating Valve, pilot operated. (Pilot operating fluid discharges to outlet pipe; not wasted).Sizes: 2" to 12". Highest pressures: inlet 600 lbs.; reduced 250 lbs. Iron, bronze, or steel bodies; standard trims. For water, air, non-corrosive gases and oils. Get interesting Bulletin 966.

PREVENT

Rust·Scale·Dirt

FROM CLOGGING
STEAM EQUIPMENT



YARWAY
STRAINERS

"The Screen's the Thing"

- *A High Grade Monel Woven Wire Basket* with mesh fine enough to catch the dirt—yet ample free area for passage of clean condensate, oil and other fluids.
- *Body Cadmium Plated Inside and Out for Protection Against Corrosion.*
- *Readily Removed Steel Blow-Off Bushing.*
- *Bushing Automatically Aligns Screen.*
- *Thousands in Use—Sold by Over 100 Mill Supply Houses.*
- *6 Sizes ½" to 2" for Pressures up to 600 Lbs.*

See Your Supply House or write for Bulletin S-200

YARNALL-WARING COMPANY
100 MERMAID AVENUE PHILADELPHIA 18, PA.

YARWAY STRAINERS

efficiency and a restricted selection. A survey should use the price structure of the long-time market or that enforced under the National Bituminous Coal Act, rather than prices obtained under wartime fuel shortages. A suggested list of important survey items appears in the table on page 102.

While the foregoing is based on a study of coal, other fuel sources—oil, gas, wood waste, etc—must be correspondingly analyzed. To arrive at total steam cost, items such as operating labor, interest, investment depreciation, etc, may be included.

Such analyses and surveys enable engineers to select equipment that takes advantage of economical fuel purchases, thus obtaining lowest steam costs.

Flood-Control Engineers Get Potomac River Plan

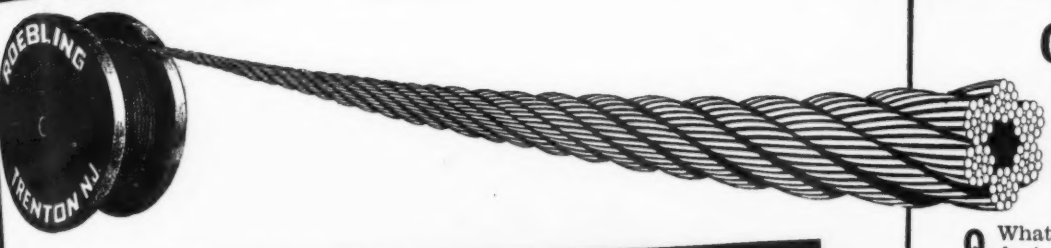
Board of Army Engineers for Flood Control has received a plan for development of the Potomac River watershed, for flood control and power development, to cost $235,720,000 and to develop an estimated 350,000 kw of hydroelectric power. The plan, which has been made public but may be seen only at Army Engineers headquarters, calls for 15 dams and reservoirs in Va., W. Va., and Md. The project has been under study for almost ten years and probably will be laid before Congress by summer when the second Rivers and Harbors Bill of the year is introduced.

While no official breakdown of power facilities for the various dams is immediately available, the facilities are to be installed in at least 13 of the dams over the 20 years anticipated by the engineers as the period for carrying out the whole development. Total annual outlay is estimated at $11,800,000.

Projects listed in the report include: Multiple-purpose dam at Riverbend and power dams at Chain Bridge and Bear Island—all on the Potomac near Washington; power dam at Harpers Ferry; multiple-purpose dam at Millville, on the Shenandoah River, Va.; multiple-purpose dam on the Cacapon River at Ede's Fort, W. Va.; multiple-purpose dam on Patterson Creek, W. Va.; dam at Keyser, W. Va., to divert water into Patterson Creek; multiple-purpose dam on Potomac's south branch at Royal Glen, near Petersburg, W. Va.; multiple-purpose dam on the north fork of Shenandoah River at Brock's Gap, W. Va.; power dams on Potomac at Rockymarsh Run, Pinesburg, Orleans and multiple-purpose dam at Springfield on south branch of Potomac— all on the W. Va.-Md. border; and completion of small dam on Savage River west of Cumberland, Md.

Monsanto Chemical Co plans to construct a new sulphuric acid plant with a yearly capacity of 72,000 tons, in plant area of its Monsanto, Ill., properties. New plant will cost about $700,000.

ROEBLING



QUESTIONS AND ANSWERS

Q What is meant by the designations of 6x7, 6x19, 8x19, and 6x37 rope?

A **Each of the above designate a particular group of classification of wire rope: the 6x7 rope contains 6 strands of 7 wires each, whereas the 6x19 rope contains 6 strands with from 16 to 25 wires per strand. The 8x19 rope contains 8 strands with from 16 to 25 wires per strand, while the 6x37 rope contains 6 strands having from 26 to 46 wires per strand.**

Q How do the above groups or classifications of ropes compare as to abrasion resistance and flexibility?

A **The 6x7, 6x19, 8x19 and 6x37 ropes are rated as listed with respect to abrasion resistance, the 6x7 having the greatest resistance to abrasion. The flexibility of these ropes follow in the same order with the 6x7 having the least flexibility.**

CHOOSE WIRE ROPE FOR THE LONG PULL!

GOING UP . . . are elevator speeds, loads, and traffic. . . and the responsibility of elevator wire rope to deliver—day in and day out, smoothly, *safely*. That's why, when the heat's on to meet these increased demands, you can have confidence in Roebling "Special Traction Steel" Elevator Rope . . . with its all-around, built-in quality specially developed for this use.

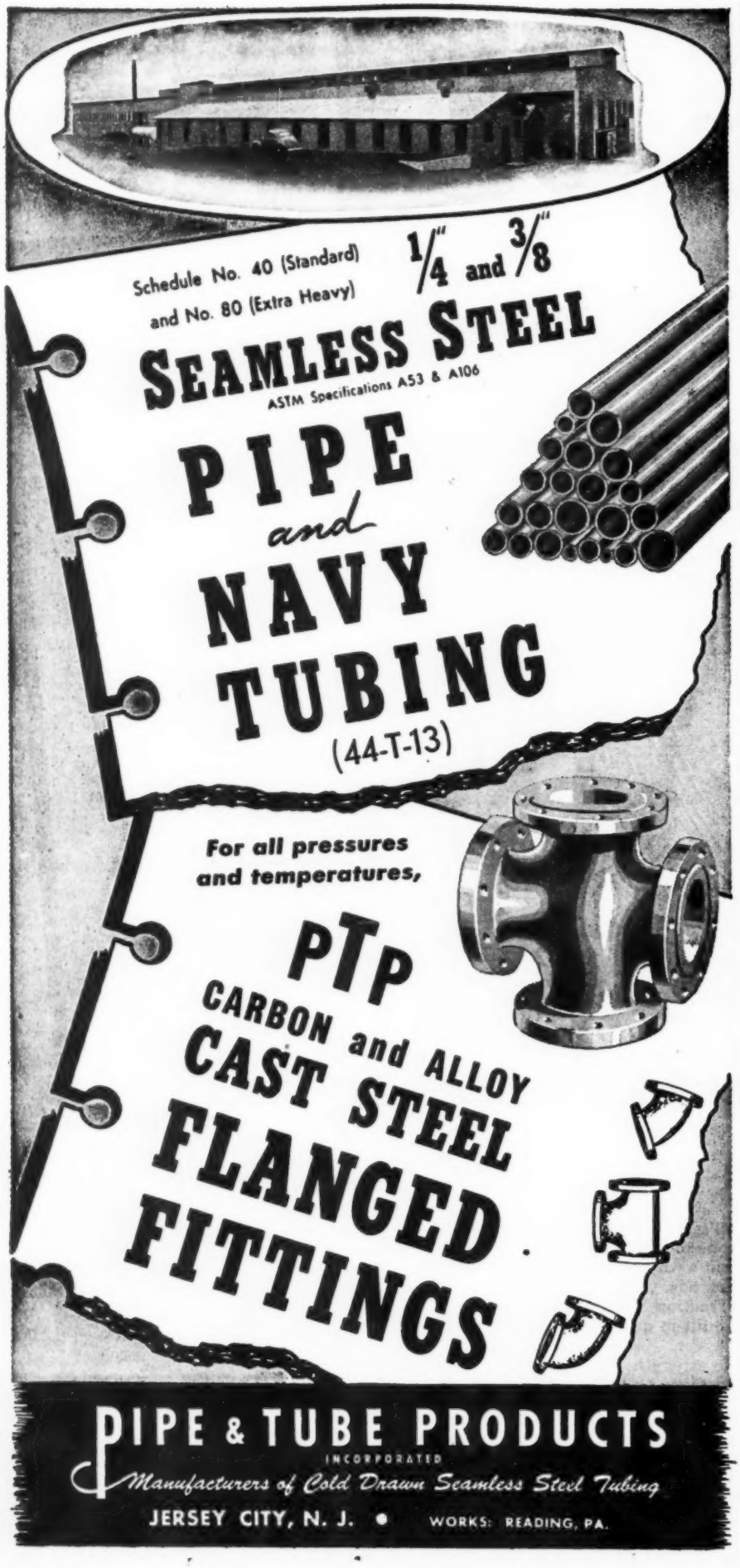
Precision-engineered . . . to combine strength and flexibility with fatigue-and-abrasion resistance to best advantage for the purpose, Roebling "*Special Traction Steel*" Elevator Rope reduces maintenance problems, expensive shut downs . . . and operation costs.

And remember that Roebling, with a century's background of wire specialization, can help you choose the right rope for your job. Check with our nearest branch office, and get started on the way to increased output from your elevator equipment. Our wire rope engineers are always at your service.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON 2, NEW JERSEY
Branches and Warehouses in Principal Cities

WIRE ROPE AND STRAND • FITTINGS • SLINGS
ELECTRICAL WIRES AND CABLES • COLD ROLLED STRIP
WIRE CLOTH AND NETTING • SUSPENSION BRIDGES AND CABLES • HIGH AND LOW CARBON ACID AND BASIC OPEN HEARTH STEELS • ROUND AND SHAPED WIRE • AERIAL WIRE ROPE SYSTEMS • AIRCORD, SWAGED TERMINALS AND ASSEMBLIES

PACEMAKER IN WIRE PRODUCTS



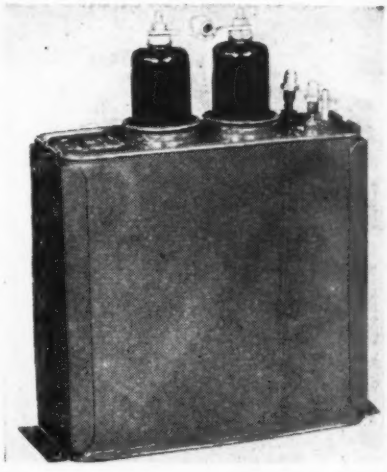
New Equipment

(*Continued from page* 126)

Thus any engine built as a diesel can be fitted to burn gas on the high-efficiency diesel cycle and if equipped with proper controls can change from one fuel to another instantaneously, or burn a mixture of oil and gas. Engines embodying this dual-fuel arrangement are in production. *Cooper-Bessemer Corp, Mt. Vernon, Ohio.*

Portable Heater

OUTDOOR WORK can be carried on in zero weather with aid of portable heater. It employs same whirling-flame principle as *Janitrol* aircraft heater. The portable burns gasoline, kerosene or oil. Heater may be used for drying purposes. *Surface Combustion Corp, Toledo, Ohio.*

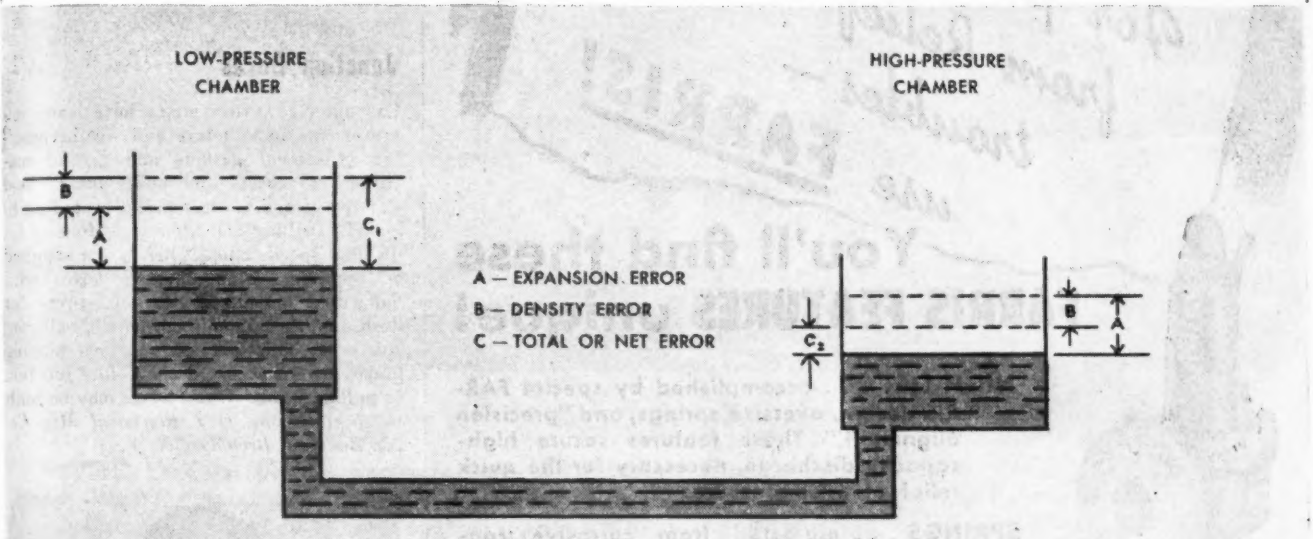


Parallel-Plate Capacitors

HIGH-FREQUENCY parallel-plate capacitors are for resonant circuit or tank circuit of high-frequency electronic oscillators, such as those used in electronic-heater equipment. When connected in parallel with an inductance coil, this class HFP water-cooled capacitor constitutes the resonant circuit which determines oscillator frequency. In this application, capacitors are operated at relatively high voltages and may be required to carry heavy currents continuously at frequencies up to several megacycles. Following features make them particularly suitable for this service: low losses at high frequencies, uniformly high dielectric strength, high-current rating per unit volume and convenient mounting and connection facilities. These units are in standard ratings ranging from 2000 v, 0.025 microfarad to 9000 v, 0.0056 microfarad.

These capacitors employ a synthetic dielectric liquid which is adapted for high-frequency applications. Cases are filled with liquid dielectric under vacuum to assure freedom from trapping of air. Constructed of nonmagnetic metal with hermetically sealed joints, case sides are flexible enough to take care of liquid expansion due to

METER-MAKING STRATEGY LICKS TEMPERATURE ERRORS!



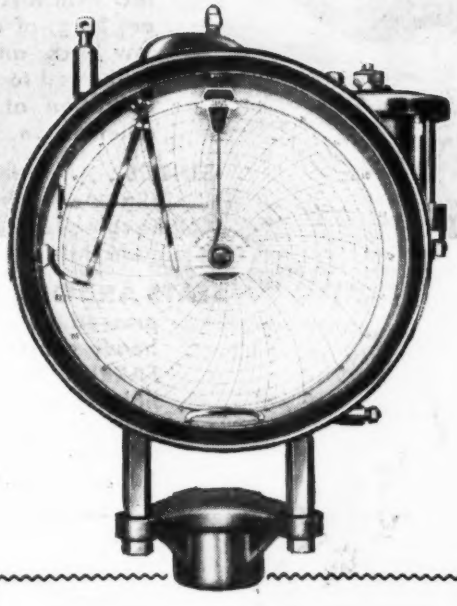
Schematic diagram showing two distinct error-factors (exaggerated for clarity) which enter differential flow meter operation with any increase in atmospheric temperature. The mercury-volume increases, tending to raise mercury level by the same increment (A) in both high- and low-pressure chambers. At the same time, mercury-density decreases, resulting in greater travel for a given differential. This tends to raise the level in low-pressure chamber and lower it in high-pressure chamber by equal amounts (B). Thus, if float is located in low-pressure chamber, expansion error (A) and density error (B) combine to form larger error (C_1). With float in high-pressure chamber, (A) and (B) are counteractive, leaving only negligible net error (C_2).

Foxboro Engineering disproves practice of locating float in low-pressure chamber

Every detail of a Foxboro Flow Meter illustrates why you get "more for your money" when you buy a unit that is systematically engineered, instead of put together on a basis of fixed habit.

Foxboro's "strategy" of locating the meter float in the high-pressure chamber, rather than the low-pressure, is one of many typical examples. Based on broader understanding of basic principles, this simple design feature utilizes two inherent sources of thermal error to offset each other. The result is sustained accuracy throughout the range, winter and summer alike!

Even for your simple installations, it costs no more to get Foxboro Meters built with such exacting refinements throughout! Write for detailed information on these money-saving meters. **The Foxboro Company, 68 Neponset Ave., Foxboro, Mass., U. S. A.** Branches in principal cities.



EXCLUSIVE FOXBORO REFINEMENTS

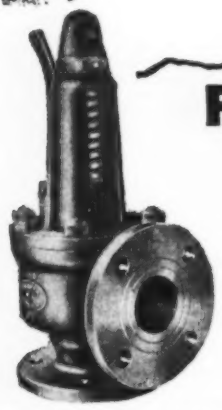
- **Segmental Lever Transmission gives straight-line calibration.**
- **Extra-large Float with long travel for extra power.**
- **Sure-Seal Check Valves positively prevent mercury losses.**
- **Pressure-Tite Bearing eliminates stuffing box and packing.**

FOXBORO REG. U. S. PAT. OFF.

DIFFERENTIAL-TYPE FLOW METERS

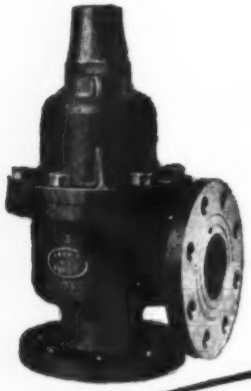
Rx For prompt relief— from Relief Valve troubles— use FARRIS!

You'll find these FARRIS FEATURES unique!



FARRIS exposed spring Relief Valve No. 1100. Naval type, high capacity, with test lever. For liquid and backpressure service; pressures to 350 lbs. at 500° F. Sizes ½" to 4".

Another FARRIS Liquid Relief Valve, No. 1450. Enclosed spring, pressure-tight cap. Also test-lever and pop types. Screwed outlet available. For pressures to 600 lbs. Sizes 2" to 8"



HIGH LIFT . . . accomplished by special FARRIS design, oversize springs, and "precision alignment." These features secure high-capacity discharge, necessary for the quick relief of over-pressure.

SPRINGS . . . protected from corrosive contact with discharged fluids. FARRIS springs are long, of carbon steel, low fibre stress, low pitch, and cadmium plated. Carefully calibrated to deliver accurate, dependable operation at the exact pressure set for relief action.

GUIDES . . . protected by FARRIS "precision alignment" from fouling; no sticking, or hanging due to distortion. Instant-action guarded!

SEATS AND DISCS . . . renewable — neither pressed nor rolled in. Special alloys and heavy construction fortify wear-resistance. FARRIS "Precision Alignment" produces tight precision reseating instantly after over-pressure is relieved, which minimizes the duration of relief action for economical operation.

Drop us a line with full details of your Relief or Safety Valve problem. Our Engineering Department will gladly furnish recommendations for the proper valve — without obligation on your part!

Write today for our Specifications Bulletin

FARRIS ENGINEERING COMPANY

366 Commercial Ave., Palisades Park, N. J.

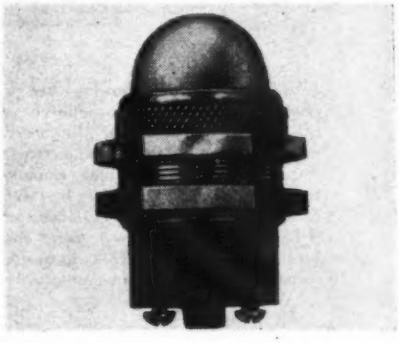
Farris

SAFETY and RELIEF VALVES

temperature changes. Capacitor unit is for water cooling. This permits an unusually compact assembly which results in a high-current rating per unit volume. Relatively small size of these units is of particular importance for built-in applications in electronic equipment where space is at a premium. *General Electric Co, Schenectady 5, New York.*

Junction Boxes

CAST-IRON JUNCTION BOXES have many improvements in structure and weatherproofing. Clean-cut gaskets and careful machining of covers and boxes make them waterproof and moistureproof, according to maker. Drilling and tapping is done to individual specifications. Bosses are supplied as required. Line includes boxes with flanged or unflanged recessed covers for flush or surface mounting or light wall construction, sidewalk boxes, overlapping hinged-cover boxes and heavy-duty junction or pulling boxes. Other boxes may be built to specifications. *O Z Electrical Mfg Co, 262 Bond St, Brooklyn, N. Y.*



Indicating Light

DE LUXE NO. 659 D/E UNIT for 120-v service is of such shallow depth, according to maker, that it can be placed where most other units cannot be used. Over-all depth behind panel front to extreme end of insulation barrier is only 1 in. It is for single-hole mounting in a $1\frac{3}{8}$-dia hole in panels up to $\frac{1}{4}$-in. thickness. Exposed holding lip, $\frac{5}{16}$ in. thick, is of hex-nut type. Hex nut offers ideal means of holding unit when it is being mounted and holding nut is being secured in place.

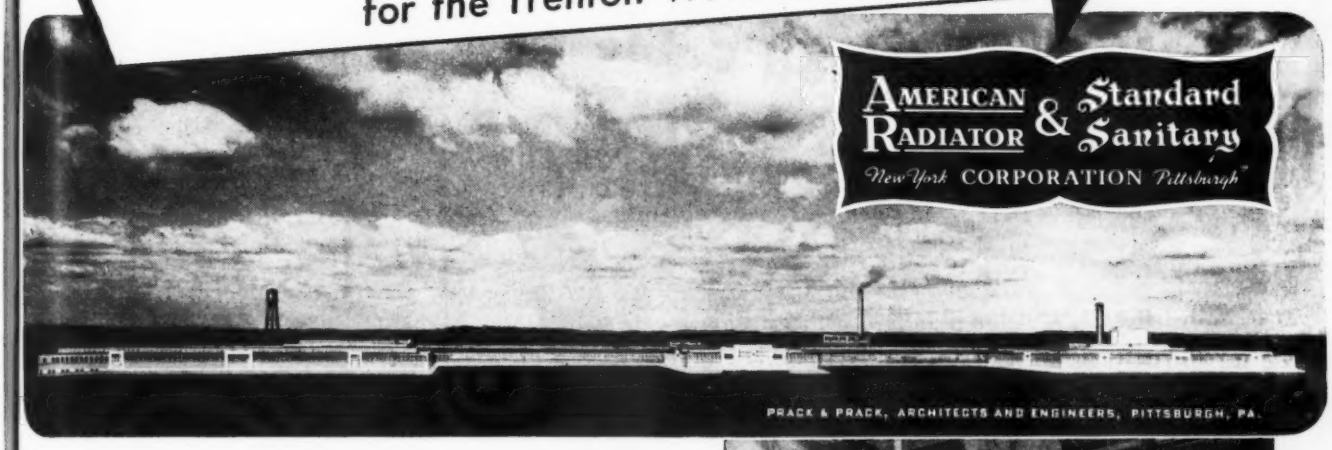
Screw lens cap, which contains heavy-walled glass lens, is removed from panel front and allows easy installation and removal of lamp bulb. As the bulb protrudes well into lens cup, brilliant visibility is effected from all forward angles. *H R Kirkland Co, Morristown, N. J.*

Slip Clutch

HEAVY-DUTY SLIP CLUTCH transmits power between shaft and gear, sprocket, sheave or pulley mounted on extended sleeve. Outer driving ring bolted to extended sleeve engages lined plate by gear-tooth splines. Asbestos linings, riveted to each side of lined plate, bear against friction surfaces of hub flange and pressure plate. The latter is mounted on hub with gear-tooth splines. Pressure on friction surfaces is obtained by

POWER by SKINNER "UNIVERSAL UNAFLOW" STEAM ENGINES

for the Trenton Works of


AMERICAN RADIATOR & Standard Sanitary
New York CORPORATION Pittsburgh
PRACK & PRACK, ARCHITECTS AND ENGINEERS, PITTSBURGH, PA.

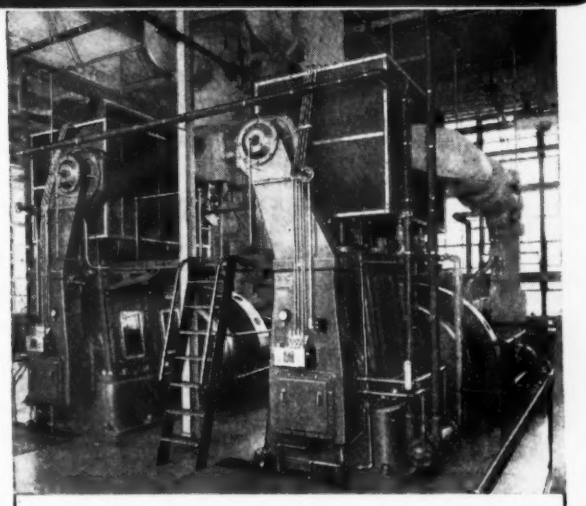
THE Trenton Works of the American Radiator & Standard Sanitary Corporation is a landmark to travelers on the Pennsylvania Railroad between New York and Philadelphia. It was originally the plant of the Thomas Maddock's Sons Company. In 1929 the plant and business were purchased, and in 1940 it was necessary to double the size of the plant.

This big pottery, producing "Standard" Vitreous Plumbing Fixtures, covers 597,450 sq. ft. It is the last word in efficiency. Raw materials are delivered at one end of the plant and, in a continuous flow through pug mills and tunnel kilns, come out at the other end ready to be loaded on the cars for shipment to all points of the compass.

In 1925 two Skinner Horizontal "Universal Unaflow" Steam Engines, of 400-kw. and 200-kw. capacity were installed in the original Maddock's plant. The enlarged plant naturally required more power, and also, naturally, two new 500-kw. Skinner "Universal Unaflow" Engines, two-cylinder vertical type, were selected to do the job. The 400-kw. engine has been retained for reserve power, while the 200-kw. is still functioning efficiently for another owner.

Our associations with the companies now embodied in the great "American-Standard" Corporation extend back well toward the last century. Today six Skinner "Universal Unaflow" Engines are furnishing power in four of their plants: at Trenton, N. J.; Bayonne, N. J.; Elyria, Ohio; and Litchfield, Ill.

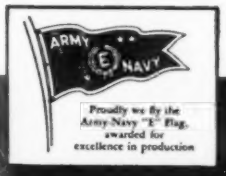
This is another illustration of the fact that "Universal Unaflow" Engines make friends—*and keep them.*



Engine Room of the Trenton Works, showing the two 500-kw. Vertical "Universal Unaflow" Units. The 400-kw. Horizontal, at the right of these two, could not be shown in picture.

Some Users of "UNIVERSAL UNAFLOW" ENGINES

Hotels, Clubs	Leather Products
Schools and Colleges	Furniture & Woodworking
Hospitals, Homes	Printing, Publishing
Public Institutions	Paper, Paperboard
Department Stores	Laundries, Cleaners
Office Buildings	Oil Refineries
Railroads	Stone and Brick
Meat Packing	Gas Plants
Dairies	Municipal Water & Electric Plants
Breweries	Cotton Oil Mills, Gins
Food Products	Rubber
Ice & Cold Storage	Glass
Mining	Bakeries
Chemical, Ordnance	Tobacco
Drugs and Soaps	
Machinery Mfrs.	
Textiles	



Do More Than Before—Buy EXTRA War Bonds

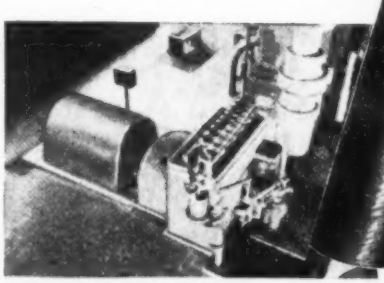
For Over 75 Years, Doing One Thing Well—Building Steam Engines

SKINNER ENGINE COMPANY, ERIE, PA.

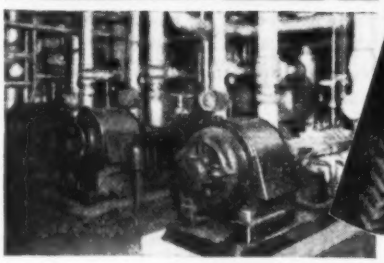
DELTABESTON
Asbestos-insulated Cables
DON'T BAKE OUT

If excessive heat is causing frequent failures in the electrical circuits of your power plant, it's time to rewire with Deltabeston Asbestos-insulated Cables. Deltabeston is used extensively for general power wiring, lighting and control circuits. Power engineers can't afford to speculate with ordinary cables particularly in places where heat is the essential problem. They rely on Deltabeston because they know from experience that despite extremely high ambient temperature, these asbestos-insulated cables don't bake out.

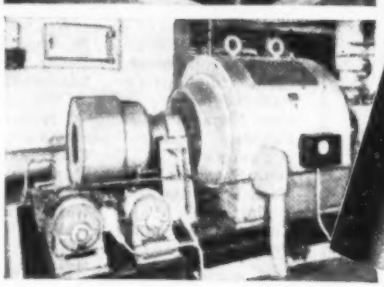
General Electric manufactures a complete line of Deltabeston Asbestos-insulated Wires and Cables for installations where severe operating conditions prevail. There's a cable to meet your most exacting requirements. Here are only a few of the many types.



Deltabeston Power Cable Types AVA for general wiring in power plants, boiler rooms, furnaces and in other torrid zones where constant high temperatures prevail. Insulated with felted asbestos, varnished cambric insert, and asbestos braid or lead sheath.



Deltabeston Boiler Room Wire Type AVA for wiring in boiler rooms, central stations, steel mills and other "hot spots". Insulated with felted asbestos, varnished cambric and asbestos braid.



Deltabeston Apparatus or Motor Lead Wire Type AVA for wiring apparatus in power plants, steel mills, boiler rooms, etc., where flexibility at high heat is desired. Insulated with felted asbestos, varnished cambric and asbestos braid.

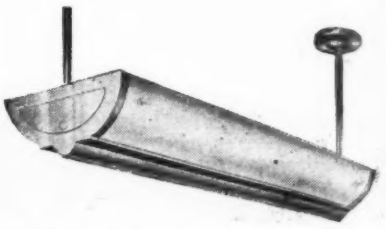
For additional information write to Section Y454-52, Appliance and Merchandise Dept., General Electric Co., Bridgeport, Conn. Deltabeston Cables are distributed nationally by Graybar Electric Co., G-E Supply Corp., and other G-E Merchandise Distributors.

BUY WAR BONDS AND HOLD THEM

GENERAL ELECTRIC

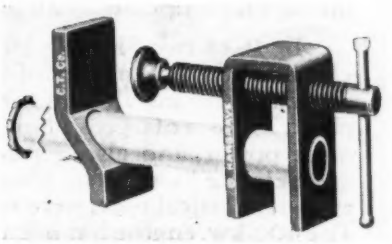
a series of coil springs placed between pressure plate and a collar carried on gear-tooth splines of hub.

An adjusting nut, threaded over end of splines, provides for regulation of spring pressure and determines torque setting at which clutch will slip. Positive locking position for adjusting nut is provided by each individual spline on hub and large number of splines permits close torque adjustment. Units can be furnished in a variety of designs, including couplings, in both single- and multiple-plate types. *Hilliard Corp, Elmira, N. Y.*



Lighting Fixture

SUSPENDED 24 TO 30 IN. beneath ceiling in individual or end-to-end lighting arrangements, *Guth Cadet Luminous-Indirect Luminaire* is made in 48- 60- and 96-in. lengths for 40- and 100-watt lamps. Translucent cream-white deflectors deliver in ratio of 90% upward and 10% downward. For best results off-white ceilings are recommended with lighting system. Illumination on vertical simulates that of the horizontal, which insures reading ease on inclined as well as on flat planes. Pen or pencil lines are easily seen because of absence of direct glare and almost total absence of reflected glare. *Edwin F Guth Co,* 2621 *Washington Ave, St. Louis* 3, *Mo.*

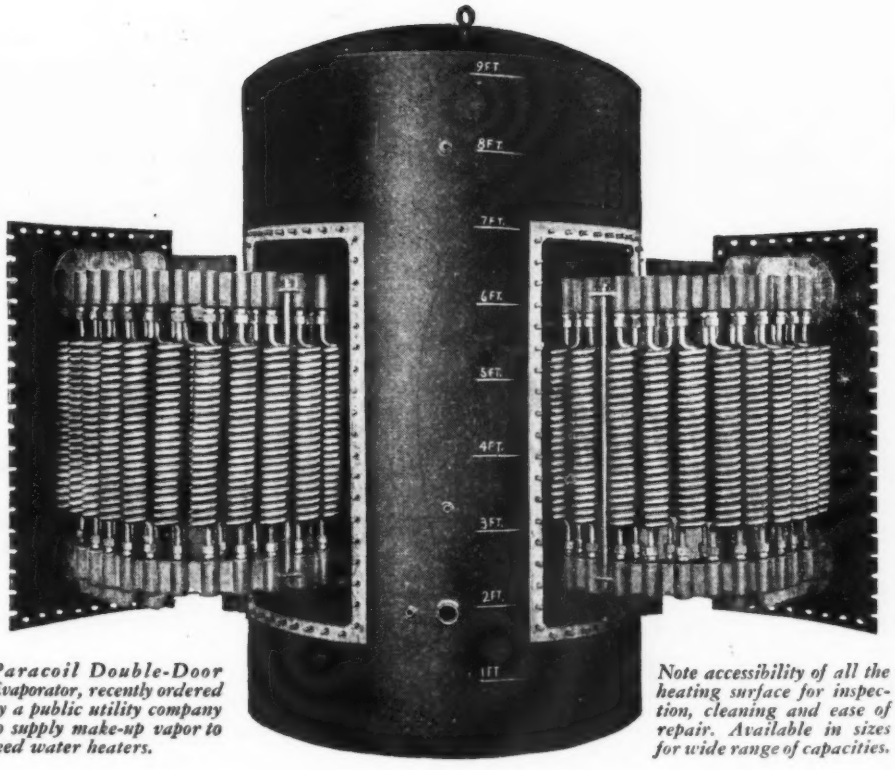


Clamp Fixture

STEEL CLAMP FIXTURE is ideal for wood glueing and metal welding. It fits ½-in. pipe in any length so that clamp of any size opening can be made. Slide will not slip on pipe under pressure, yet it is easily released when pressure is removed. Clamping surface is 1½x1½ in. *Cincinnati Tool Co,* 4093 *Montgomery Rd, Cincinnati* 12, *Ohio.*

Fluorescent Lamps

LONG-SLIM sums up physical appearance of new fluorescent lamps. The 42- and 64-in. lengths will be produced in a ¾-in. dia and 72- and 96-in. in 1-in. dia. All models will use a single-pin base. Lamps are of instant-starting type, requiring no starter. Elimination of this accessory, according to maker, will reduce maintenance. Lamps have a higher lumen per watt output than



Paracoil Double-Door Evaporator, recently ordered by a public utility company to supply make-up vapor to feed water heaters.

Note accessibility of all the heating surface for inspection, cleaning and ease of repair. Available in sizes for wide range of capacities.

Plan Now...for Maximum POSTWAR EFFICIENCY

TO eliminate any possibility of delay that other peacetime replacement demands may create, far-sighted plant officials have already started to check Heat Exchange equipment to determine that which may be obsolescent, depreciated beyond repair or insufficient in capacity for present or future loads. Equipment which has proved uneconomical or unsuited to present or contemplated operating conditions, and that which requires continuous costly servicing likewise indicates the necessity of carefully planned replacement.

Orders for the units listed in column at right can now be filled on reasonable delivery schedules, if accompanied by suitable priorities. Davis engineers will help you to prepare for maximum peacetime efficiency in selection of Heat Exchange Equipment. We will be pleased to submit recommendations or proposals on your particular heat transfer problems or requirements.

SINCE 1915
Paracoil
HEAT TRANSFER EQUIPMENT

Paracoil

These Paracoil products will fill many of your replacement or new equipment needs.

EVAPORATORS
For boiler water make-up.

DISTILLATION PLANTS
To supply distilled water for process.

FUEL OIL HEATERS
For service-free operation.

CLOSED FEED WATER HEATERS
For higher temperatures.

WASTE HEAT BOILERS
For heat recovery from diesel engine exhaust.

BLOW DOWN HEAT EXCHANGERS
For recovery of heat from boiler blow down.

CONDENSATION COOLERS AND PREHEATERS
For recovery of heat from waste liquids.

CONDENSERS
For recovery of vapors.

WATER HEATERS AND MISCELLANEOUS HEAT EXCHANGERS
For process heating or cooling.

DAVIS ENGINEERING CORPORATION
1066 EAST GRAND STREET, ELIZABETH 4, NEW JERSEY

Your
ASSEMBLY SAVINGS
also
CUT SERVICING TIME

THE HOURS YOU SAVE in factory assembly by simply *peeling* precision laminations for accurate fitting of machine parts will be repeated by your users on every service adjustment. Want performance data and photo chart of applications?

Laminum shims are cut to your specifications, but shim materials for repair are sold through your industrial distributors.

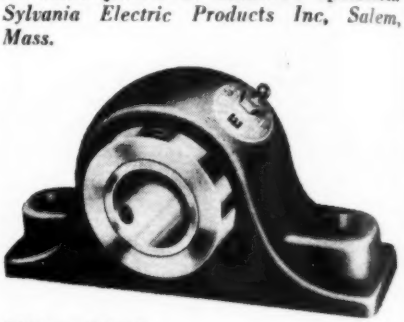
Laminated Shim Company, Incorporated
61 Union Street • Glenbrook, Conn.

LAMINUM
THE SOLID SHIM THAT peels FOR ADJUSTMENT

2213

previous models. Two levels of light output may be obtained by proper selection of ballasts. At present, these lamps are being produced in sample quantities only. Sockets and ballasts will not be available for several months.

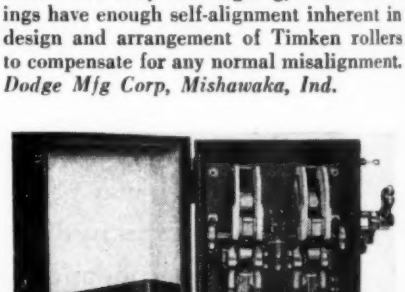
Another addition is a 13-watt miniature lamp, 21 in. long and $\frac{5}{8}$-in. in dia. This lamp is of conventional starting design, but will require a new ballast for operation. *Sylvania Electric Products Inc, Salem, Mass.*



Pillow Block

TYPE E BEARING is now available in both pillow blocks and flanged units. Method of fastening to shaft is simple and effective. On each end of extended inner race is a steel collar having two headless set screws spaced 120 deg apart and extending through clearance holes in inner race to shaft. These four set screws provide a positive lock to prevent rotation of inner race on shaft.

Simple labyrinth seals prevent loss of lubricant and protect bearings against damage from dust, dirt or moisture. They are equally effective whether bearing is on or off shaft. Bearings are completely assembled, lubricated and adjusted at factory. While not fully self-aligning, these bearings have enough self-alignment inherent in design and arrangement of Timken rollers to compensate for any normal misalignment. *Dodge Mfg Corp, Mishawaka, Ind.*



Safety Disconnect Switch

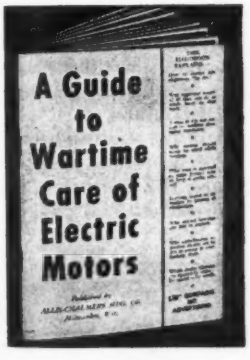
MANUAL-MAGNETIC CRANE safety disconnect switch, of dc double-pole design, inclosed in Type 1 (general purpose) cabinet, meets requirements for an easy-to-operate disconnect switch. Type 1-A (semi-dusttight) inclosures are optional. Switch has externally operated handle, arranged for padlocking in the off position. Pushing handle up energizes operating coil of double-pole contactor to close switch. Pulling handle down opers coil circuit to disconnect switch and also forces contacts to open manually if main contactor fails to open by breaking control circuit.

Switch, in two sizes for crane service, is built with three optional arrangements

FIRST AID FOR MOTORS

MOTORS RUN A FEVER? No wonder if they do more often today. They're working *3 and 4 times* as many hours as in peace!

Wartime conditions demand you diagnose motor ailments *quickly* ... remedy the trouble at once. At right are but few of the many diagnoses found in Allis-Chalmers' new "Guide to Wartime Care of Electric Motors". In maintenance as in war, *attack is the best defense.* This book singles out the 9 main enemies of electric motors . . . tells you how to get them *before* they get your motors!



Over 100,000 copies already in use.

Write today for your *free* copy. ALLIS-CHALMERS MFG. CO., MILWAUKEE 1, WIS.

SYMPTOMS YOU CAN SEE

Symptom	Possible Causes	Cure
1. Excessive sparking or flashing at brushes. Blackened commutator.	Rough commutator.	Sand or turn down, depending upon depth of surface roughness.
	Low bar on commutator.	Grind or turn down balance of commutator.
	High bar on commutator.	If extreme, lower with mallet, tightening clamping ring. Grind true.
	Brushes too short.	Replace with harder grade—if worn too soon . . . and not by rough commutator.
	Shorted armature winding.	Test for short—after removing metallic contact between commutator bars. Repair.
2. Intermittent sparking at brushes.	Open armature winding.	Locate and replace bad coil—or repair defective joint.
3. Motor won't start.	Usually line trouble.	Correct. Check source of power supply.
	Load too heavy. See if motor runs without load.	Reduce load—or replace motor with unit of greater capacity.

SYMPTOMS YOU CAN HEAR

4. Excessive hum.	Uneven air gap. Measure with feelers.	Replace bearings—before introduction of scraping noise indicates rotor is rubbing.
	Unbalanced rotor. Check on parallel bars.	Balance with solder on band—or weight attached by cap screw and lock washer.
5. Regular clicking.	Matter in air gap.	Take out rotor; remove matter.
6. Rapid knocking	Misalignment.	Realign set until knocking disappears.
7. Brush "chatter."	Extreme vibration.	See item 10, below.

SYMPTOMS YOU CAN FEEL

8. Vibration.	Misalignment.	Realign set.
	Vibration in driven machine.	Eliminate source in machine, if possible. Or a flexible belt drive may be in order.
9. Motor overheating. (Check with thermometer — don't depend on hand).	Overload. Measure load; compare with nameplate rating.	Check for excessive friction in motor, drive or machine. Reduce load, or replace motor with greater capacity unit.
	Dirt in motor. Check flow of air.	Blow out motor. Use solvent on wound section if necessary.
	Rotor rubs stator.	Replace bearings.

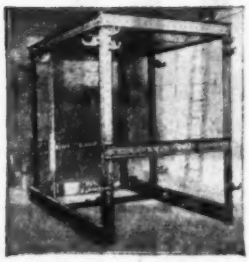
A 1638

ALLIS-CHALMERS MOTORS

When you do need new motors, look into the strength, solidity and all-around protection of the new "Safety Circle"—protected top, sides, ends and bottom.

AC WE WORK FOR VICTORY WE PLAN FOR PEACE

Front and side furnace water-wall sub-assemblies ready to be hung on structural frame work.

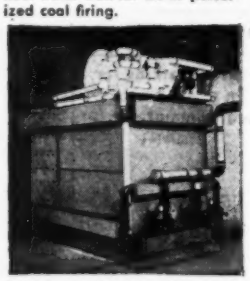


Erected boiler frame or structural frame work.

Convectors, rear, roof and side furnace water-walls, with special floor water-wall for oil or pulverized coal firing.

Furnace water-walls and convectors erected with steam drum in place showing insulated steel casing detail.

Boiler enclosed, insulated steel casing showing water-wall and convector discharge piping connected to steam drum.



Boiler completely enclosed with insulated header boxes in place.

A New and Better Way to Erect a Boiler on the Job

THE erection on the job of a Type LFS, International-LaMont Forced Recirculation Boiler is quicker, and easier than any other water tube boiler. Pressure parts of the unit are pre-fabricated, sub-assembled and tested in the shops before shipment. Other parts are sub-assembled and checked for quick erection on the job. In small sizes, the boiler unit can be shipped completely assembled.

Other distinctive features of the Type LFS Boiler are:

The boiler is in complete circulation before the fire is started.

The steam drum is an unfired pressure vessel.

Higher efficiencies due to maximum radiant heat absorbing surface in furnace water-walls and effective arrangement of secondary heating surfaces

Extreme flexibility—follows swinging load from no load to maximum load instantaneously.

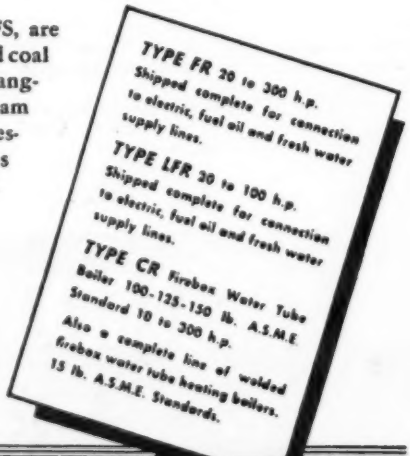
Steady water line and dry steam under all load conditions.

Minimum space requirements—low headroom a feature.

International-LaMont Boilers,* Type LFS, are designed for firing with oil, gas, pulverized coal or stokers. They are available in sizes ranging from 4,000 to 30,000 pounds of steam per hour and in all standard working pressures. Larger sizes and special pressures or superheat requirements on request.

Write today for bulletin illustrating and describing special features of this Type LFS Boiler.

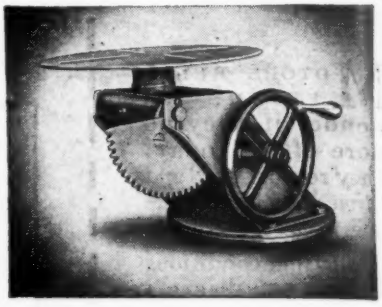
*Licensed under LaMont patents.


TYPE FR 20 to 300 h.p.
Shipped complete for connection to electric, fuel oil and fresh water supply lines.
TYPE LFR 30 to 100 h.p.
Shipped complete for connection to electric, fuel oil and fresh water supply lines.
TYPE CR Firebox Water Tube Boiler 100-125-150 lb. A.S.M.E.
Standard 10 to 300 h.p.
Also a complete line of welded firebox water tube heating boilers. 15 lb. A.S.M.E. Standards.

Boiler Builders for 59 Years

THE INTERNATIONAL BOILER WORKS CO.
POWER DIVISION
200 BIRCH STREET · EAST STROUDSBURG, PA.

of terminals to facilitate incoming and outgoing connections. Unit may also protect other machines having several motor drives, such as large machine tools with many motors, or power feeder circuit serving a number of motor-driven machines. *Electric Controller & Mfg Co, 2700 E 79th St, Cleveland* 4, Ohio.

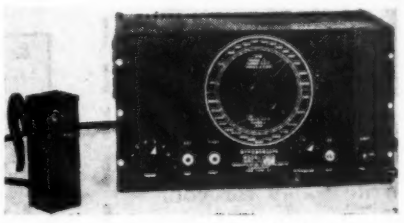


Hand-Operated Positioner

BENCH MODEL 1H POSITIONER provides a handy tool to facilitate welding, assembly, overhauling, grinding, drilling, hard surfacing and similar operations on all small work. Capacity is 100 lb, with center of gravity three in. above table. Positioner has a tilting range of 150 deg, revolves 360 deg, and can be locked in position at any degree of tilt. The 16-in. table top is equipped with $\frac{5}{16}$-in. slots. Swivel base is available if desired. *Ransome Machinery Co, 1437 S 2nd St, Dunellen, N. J.*

Connector Lug

XL SOLDERLESS LUG accommodates more than one size of wire. Made of cast copper alloy, fitting is designed so that high-clamping pressure is exerted by the pressure plate. This also insures high conductivity on any one of the wires in a wide size range. Socket wrenches are furnished without additional cost. *O Z Electrical Mfg Co, 262 Bond St, Brooklyn, N. Y.*



Stroboscope

CML MODEL 1200 STROBOSCOPE, operated from external tuning fork or crystal standards, increases range through which moving objects may be examined. Rotary speeds from 600 to 600,000 rpm, or vibrations from 10 to 10,000 cps, can be stopped and studied. Motion of objects moving at irregular speeds may also be stopped. Accurate repetitive pulse rate is obtained, according to maker, as pulses are derived from a stable audio oscillator. Not only does this eliminate necessity for constant readjustment of repetitive rate, but it also insures clearly defined images at high speeds. Small objects may be viewed easily at close range. A light-intensity control

DESIGN / PRODUCTION / MAINTENANCE

Pictured above is a group of engineered assemblies of American Flexible Metal Hose, each completed with a type of fitting or coupling to suit a specific application.

Such assemblies become an integral part of a machine or product design and serve in most exacting production and maintenance duties such as for carrying liquids, oils, grease, hot and cold water, steam, semi-solids; for absorbing vibration in feed or exhaust lines, and compensating for misalignment of tappings.

For all-around conveying duties between moving parts, such as the platens of molding presses, laundry presses; supplying steam to automobile tire molds; carrying delicate essential oils from tank to filters; serving as hydraulic oil lines on giant steel strip mills . . . and thousands of other industrial services. . . . American has a style of Flexible Metal Hose specially constructed to do the job.

American Metal Hose Assemblies withstand constant flexing for almost unbelievable periods . . . can be built to take very high pressure. For instance American "Seamless" . . . the flexible tubing with no joints, welds, seams or packing is as leakproof as the seamless rigid tube from which it is made . . . its cost per foot per hour of service is amazingly low.

American Flexible Metal Hose and Tubing has contributed mightily to war work . . . will again find even more widespread use in civilian production than it has in the last 35 years. Ask for available literature . . . get the facts on what it can do for you.

ANACONDA

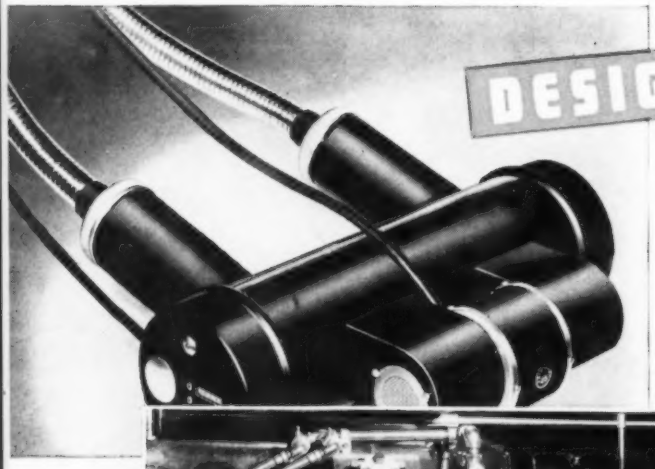
American Metal Hose

AMERICAN METAL HOSE BRANCH of THE AMERICAN BRASS COMPANY

General Offices: Waterbury, Conn. Subsidiary of Anaconda Copper Mining Company

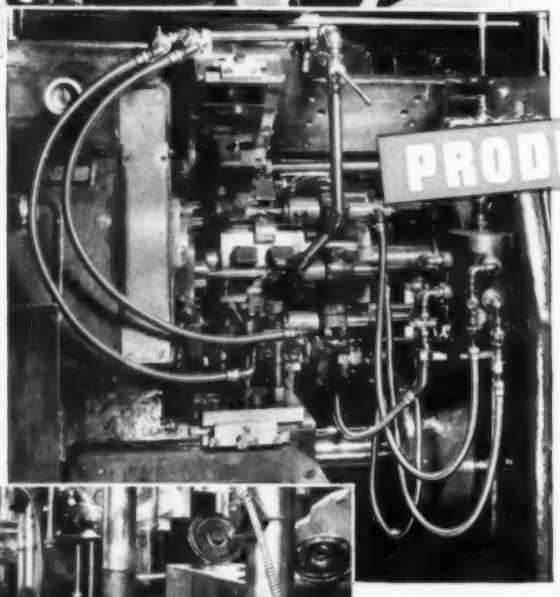
In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

FOR BETTER METHODS AND SMOOTHER PERFORMANCE IN *Design, Production* AND *Maintenance*
— AMERICAN METAL HOSE



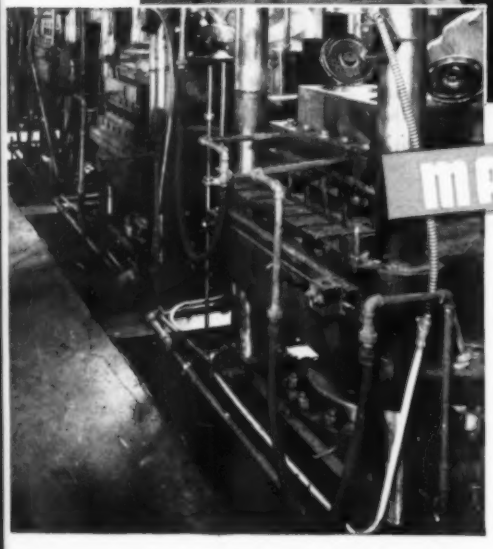
DESIGN....

Machine and Product Designers find many advantages in getting American Metal Hose on their drawing boards "*right* from the start". Appearance is enhanced, connecting and dis-connecting of pipe lines is facilitated, longer service life of machinery is assured. Note the use of "American" to protect cable on this X-ray machine.



PRODUCTION....

Oil feed lines, such as those shown on this multiple spindle automatic Bar machine, must stand up under severe conditions. That is exactly what you may expect and depend upon with all types of "American" Flexible Metal Hose and Tubing. It is equally true of steam, hot water and hydraulic pressure lines that are installed to flex with moving parts. Specify "American" for sure-fire performance, lower service costs, easier installation, and resistance to vibration.



MAINTENANCE....

Machine down-time is minimized when equipment, such as this battery of plastics presses, has flexible feed lines connected with re-attachable couplings, made the "American" way. The lines may be easily changed, or re-located to suit requirements. The maintenance duties of American Metal Hose include blowing of chips, vacuum cleaning of dust, dirt, etc., and insertions in exhaust lines to absorb vibration, expansion and contraction.

There are many places for American Flexible Metal Hose in practically every industrial plant both to improve products and decrease maintenance. Our Engineering Service will gladly make specific recommendations on request.

American Metal Hose Branch *of* The American Brass Company

General Offices: Waterbury, Conn. • *Subsidiary of Anaconda Copper Mining Company*

In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

ANACONDA

45255

BOILED DOWN

TO SIMPLIFY MOTOR SELECTION

● This new booklet gives ratings, sizes, characteristics, dimensions, where-to-use data, *and prices* of General Electric a-c and d-c motors, 1/16 to 75 hp. Everything you need to know to select these sizes—all in 16 pages!

Builders of TRI-CLAD Motors

Buy all the BONDS you can—and keep all you buy.

To Save Your Time Later Mail This Coupon Today—

General Electric Company, Schenectady 5, N. Y.

Please send me a copy of your Condensed Motor Catalog (No. GEA-4281).

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GENERAL ELECTRIC

STEAM CONDENSERS

A SHIPMENT OF MAIN CONDENSERS LEAVING OUR CARBONDALE PLANT

ALL TYPES OF HEAT EXCHANGERS

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STEAM JET AIR EJECTORS

•

COOLERS

Fresh Water — Lubricating Oil

•

EVAPORATORS

Self Descaling (Patented) — Coil Type

•

DISTILLERS

•

FEED WATER HEATERS

Low Pressure — High Pressure

•

FUEL OIL HEATERS

•

LINE THROWING GUNS

•

STEAM CONDENSERS

HEAT TRANSFER PRODUCTS

Engineers INCORPORATED *Manufacturers*

WEST COAST REPRESENTATIVE
HARRY W. PARSONS, INC.
24 California St., San Francisco

HTP

90 WEST ST., NEW YORK 6
PLANT: CARBONDALE, PA.
(90,000 square feet)

IF IT'S TRANSFER OF HEAT—CALL HEAT TRANSFER

switch is also provided for greater flexibility in controlling both light intensity and duration of pulse length. *Communication Measurements Laboratory, 120 Greenwich St, New York, N. Y.*

Fan Units

TWO AXIAL-FLOW FAN UNITS have just been developed. The 60-in. low-pressure propeller, driven with a 10-hp 1150-rpm motor, delivers about 60,000 cfm free air and 5000 cfm at ½-in. sp. It is ideal where space, economy and efficiency are important in air movement. Midget 2-in. propeller is for a complete fan unit that company will manufacture and market. It will be powered by a small motor of about two thousandths of a hp and will deliver 30 cfm at .30-in. sp.

All fans are being built in both single-stage and multi-stage varieties. Two-stage assemblies double single-stage pressure characteristics of any given unit. When multi-stage assemblies are built, guide vanes or contra vanes straighten air stream between various stages. *Dynamic Air Engineering, Inc, 1619 S Alameda, Los Angeles 11, Calif.*

Spanner Wrenches

SELF-ADJUSTING SPANNER wrenches cover a wide range of diameter sizes with only three models —⅜ to 1¼ in., 1¼ to 3 in. and 3 to 5 in. Three-point toggle action of movable jaws provides uniform pressure at geometrically spaced points and eliminates distortion or crushing of even the softest of alloy-metal spanner nuts. An adjusting screw is incorporated in two larger sizes as a stop. *Universal Engrg Co of San Diego, 2230 National Avenue, San Diego 2, Calif.*

Air Drier

FEATURES OF WATER-SORBER, a new dehumidifier, include: (1) Three receptacles specially arranged one below the other catch residue liquid in descending stages and permit this liquid, which also contains active chemical, to continue to absorb additional moisture. This terraced construction is said to add about 70% to absorption ability of chemical. (2) Chemical cubes are used in place of conventional types of absorbent. By presenting more exposed

IN THE BYRON JACKSON PNEUMATIC SPONGE

THE SIMPLE "CIRCLE S" RUNNER REDUCES WEAR— PREVENTS CLOGGING

Here's how

Point of greatest wear in any sump or sponge pump is in the runner and when pump chokes up the trouble is usually traceable to the same source. Constant replacements due to wear, as well as down time to clean pump, are materially reduced by incorporating the "Circle S" runner in the Byron Jackson Pneumatic Sponge.

This two port impeller design, first of all, permits the easy passage through the pump, to the discharge port, of any spherical solid able to enter the eye or suction intake of the pump. Second, the curved vanes of the runner are so designed that sand, gravel and other abrasives, carried in suspension in the pumped fluid, do not directly impinge upon any one section of the runner, or pump case. Instead, easy, natural flow lines are followed from entrance to discharge ports, thereby minimizing possible wear.

Rugged, compact, yet light in weight (85 pounds), the Byron Jackson Pneumatic Sponge is suitable for operation in any position. Designed for pumping heads up to 150' in single stage and 300' in two stages, solids 9/16" in diameter may be handled in the 2-1/2" size and 1-1/8" through the 3" size. The Rotary air motor operates on compressed air at pressures from 70 to 100 psi. Write today for Pneumatic Sponge Bulletin.

ARMY (E) NAVY

BYRON JACKSON CO.

Houston • LOS ANGELES • New York

ADVANTAGES OF INSTALLING

SCHRAMM

AIR COMPRESSORS IN UNIT SYSTEMS

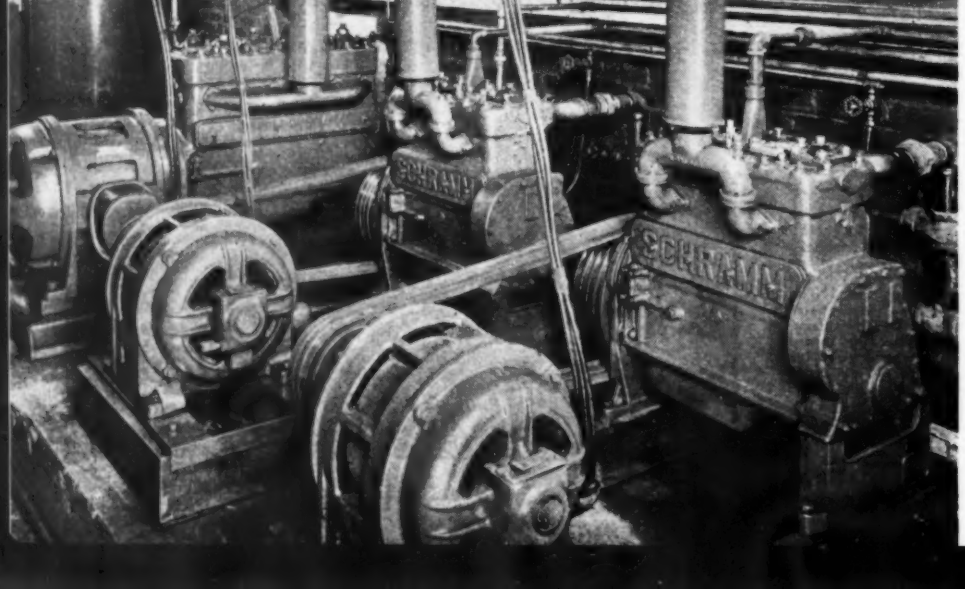
The Unit System of air compressor installations is becoming widely recognized in industry because of the many advantages in taking care of the *variable* compressor loads that exist in so many plants and shops. So often in these shops a lot of air is required at certain periods, a minimum amount at other periods, that Unit installations are desirable.

Another advantage of the unit system is to eliminate unnecessary piping by conveniently installing the compressors in different sections of your plant.

Schramm features: 100% water cooled . . . lightweight and compact . . . is vibrationless, even when providing great amounts of air. These—and many other features—make Schramm the economical air compressor. For full details write today.

SCHRAMM INC.

THE COMPRESSOR PEOPLE
WEST CHESTER
PENNSYLVANIA



surfaces and consequently a greater total absorption area to moist air, these cubes remove more moisture. (3) Air passes over chemical cubes. It enters at bottom of cube container through perforations. This provides slower, more uniform and thorough cube melting, which still further increases moisture absorption.

A single unit services from 800 to 1000 cu ft. For a larger area, use two, three, or more *Water-Sorbers. General Air Conditioning Co, Cincinnati* 9, *Ohio*.

Drill Grinder

E-Z DRILL GRINDER can be set up quickly on a grinder frame or on a bench adjacent to grinding wheel. Grinder was simplified so that only a few standard motions produce a factory finish on a dull drill in less than half a minute, according to maker. New protractor feature enables it to be set quickly for three different drill point angles, depending upon hardness of material on which twist drill is to be used. It sharpens all-round shank drills from the shortest to 11-in. length, $\frac{3}{32}$ to $1\frac{1}{16}$ dia. *Fred F Ten Eyck, 758 S Irolo St, Los Angeles* 5, *Calif.*

Heavy-Duty Test Clamps

TEST CLAMP LINE, employing tremendous gripping action, is for heavy-duty temporary connections, motor and meter testing, jumpers, cable and busbar taps, battery charging, welding, etc. A slight twist of fingertip safety knob exerts heavy pressure, supplying large carrying capacity of 20 to 350 amp on constant and intermittent duty. Solderless lugs, arranged to swivel around clamp, permit wires to hang in a natural position and provide perfect and quick electrical connections without special tools or cutting into the wire. Clamps are in six sizes to fit across ferrule and knife-blade fuse clips, switch blades, round or flat busbars, cables, etc. *Trico Fuse Mfg Co*, 2948 *N 5th St, Milwaukee* 12, *Wis.*

Self-Locking Pins

DRIV-LOK STANDARD and special self-anchoring vibrationproof pins are claimed to replace more expensive taper pins, keys, cotter pins, set screws, rivets, etc. These pins, which are pressed or driven into standard drilled holes, have four flutes on surface parallel to axis. Length and position of flute can be controlled accurately so that fully or partially grooved pins are available. Fully grooved pins have a pilot at one end so that pin can be easily inserted.

Raised, work-hardened edges of flutes provide an expanded diameter of a few thousandths greater than nominal diameter of pin. When pin is inserted in a drilled

Announcing

NEW ★ COMPACT ★ HEAVY DUTY CLIMAX BLUE STREAK V8 ENGINE

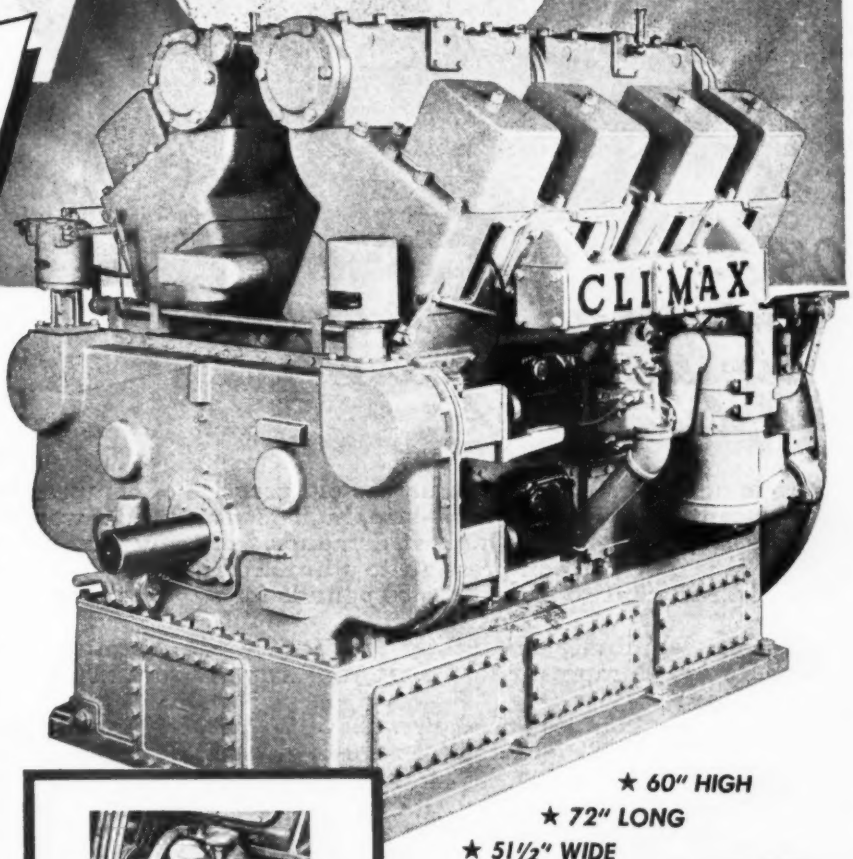
330 h.p. at 1200 r.p.m.

Climax Built-in Extras AT NO EXTRA COST!

1 *Hi-Power Blue Streak Combustion (exclusive).*

2 *Hi-Efficiency Dual Carburetion.*

3 PLUS *Staying Power—the ability to keep on doing the job.*



★ 60" HIGH
★ 72" LONG
★ 51½" WIDE

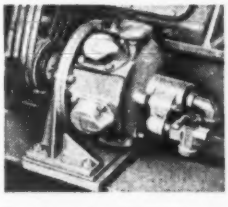
HERE IS BRUTE POWER—in small space—to operate heavy duty mobile or stationary equipment used in oil fields, construction, marine and industrial operations—to power deep-drilling rigs, locomotives, cranes, shovels, boats, generators, air compressors, water and sewage pumps, blowers, etc.

This Climax valve-in-head Blue Streak V8 (8 cylinder, 4 cycle, 7" bore, 60°) Engine is a sturdy, instant-starting, fast-accelerating, smooth-running, flexible prime mover that operates on gasoline, butane, by-product or natural gas. It runs at slow, minimum-wear speeds, at low, safe temperatures in all climates on very little water.

This new V8 promises to sustain Climax Engine records of 7, 9, 10 years' trouble-free service—as much as 60,000 hours of continuous operation with no shutdown for repairs.

For complete operation and specification bulletin, write Climax Engineering Company, Clinton, Iowa.

CLIMAX ENGINEERING COMPANY
General Offices: CLINTON, IOWA
Regional Offices: CHICAGO, DALLAS, FT. WORTH, TULSA



AIR START now available, belt connected or built-in, according to engine size, on all Climax Blue Streak Engines. Choice of air start or gasoline starting optional.

climax
BLUE STREAK ENGINE
Builder of Climax DIESELS *and* GENERATING SETS

CLIMAX ENGINEERING COMPANY

FULLER ROTARY COMPRESSORS AND VACUUM PUMPS
BUILT FOR CAPACITIES TO 1800 C.F.M. PRESSURES TO 125 LB. VACUUMS TO 29.90 IN. REFERRED TO 30 IN. BAROMETER
"SPOT" YOUR COMPRESSORS
FULLER
FULLER COMPANY

Why — compress air to 100-lb. when lower pressures will do the work?

There is no necessity to continue the old practice of compressing air at a central point with large-size, high-pressure units working on pressures equal to the highest demands from any part of the plant. It is costly to compress air to a hundred pounds or higher, and then reduce it to from 10 to 50 pounds for any one particular use.

You can eliminate this costly practice by the installation of Fuller Rotary Compressors. *"Spot your compressors where you need the air."*

Single-stage compressor shown above is one of 14 installed in a single plant, each "spotted" as close as possible to the point of utilization of the air.

Bulletin C-5 illustrates and describes these machines. It's yours for the asking.

FULLER COMPANY
CATASAUQUA, PENNSYLVANIA

Chicago 3 · 1144 Marquette Bldg.
San Francisco 4 · 421 Chancery Bldg.
Washington 5, D. C. · 618 Colorado Bldg.

No. 2 of a series

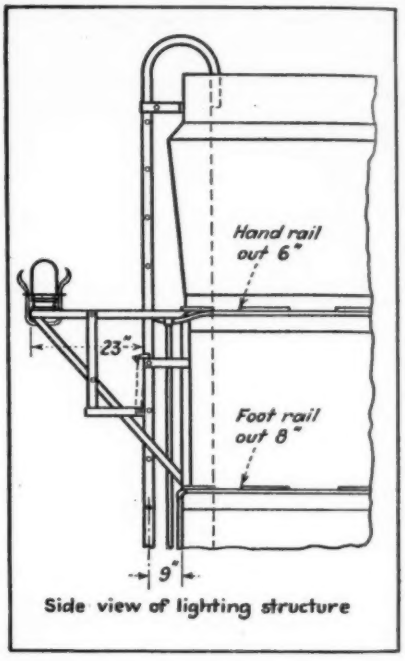
C-110

FULLER
PIONEERS OF HIGH-EFFICIENCY ROTARY COMPRESSORS

hole, these raised edges are compressed inwardly, providing a resilient, self-locking element, which, it is claimed, will hold indefinitely under vibration or shock conditions. They are available in sizes from $\frac{3}{64}$- to $\frac{1}{2}$-in. dia. and from $\frac{3}{16}$- to $4\frac{1}{2}$-in. length in any material, and in a wide variety of models. *Driv-Lok Pin Co, 565 W Washington Blvd, Chicago 6, Ill.*

Obstruction Lighting

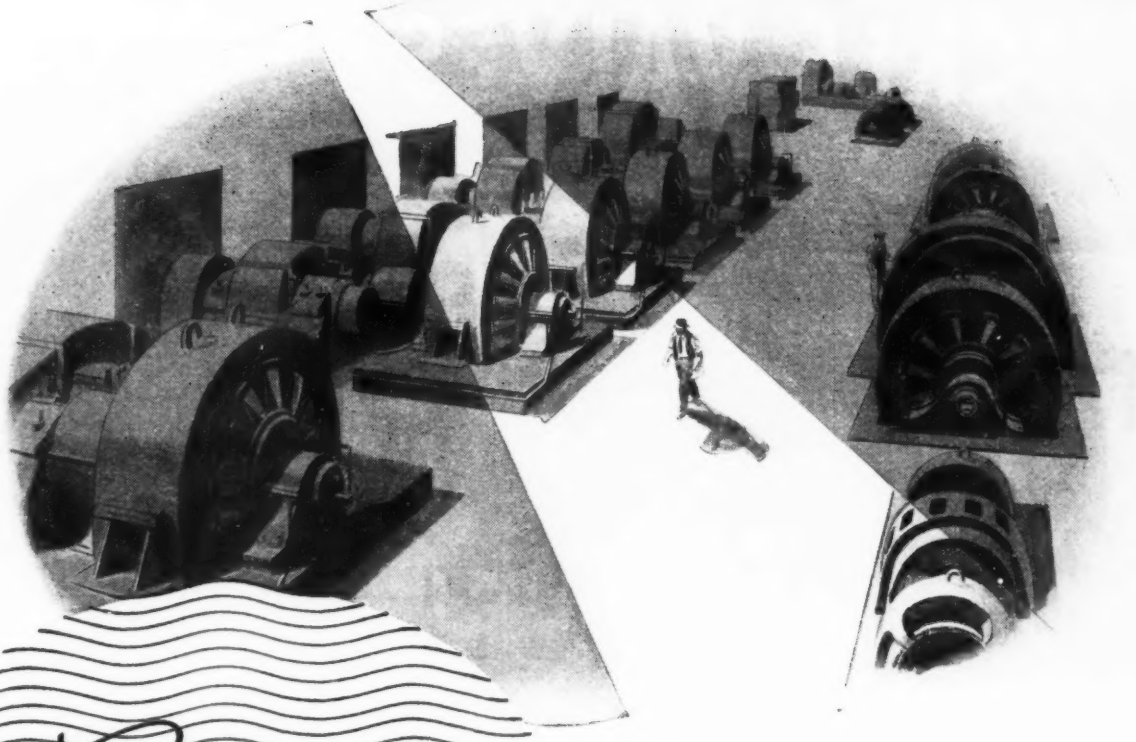
SUPPORTING STAGING for airplane obstruction lighting differs from that which has been previously used in that servicing of lights is made possible by an ascending ladder, and hand-holds and steps are firmly fastened to encircling bands so that service man can travel to lights adjacent to central ladder position. This is in contrast to other equipment with lamps affixed to cables, which hoist lamps to desired position and which may be lowered to service at ground level. It is claimed that Lamb equipment will strengthen and add life to chimney because it will be strengthened by encircling bands that support staging. Unique feature is inclusion of air jets directed at surface of lamps. Jets are operated by a valve at ground level so that an air blast can be directed at lamp surface to remove soot, which would accumulate on lamps at positions near chimney top. *Clyde K Lamb, 13236 Puritas Ave, Cleveland, Ohio.*



Side view of lighting structure

Waterproofing Chemical

CRETO IS CLAIMED to waterproof any masonry, inside and outside, with one application either to painted or unpainted surface, whether applied inside or outside, even though brick, stucco or concrete is wet when *Creto is* applied. Chemical changes component parts of masonry into one single, solid mass, preserves, stops seepage and locks in alkali and lime if concrete is to be painted. *Guaranteed Products, 1117 Crenshaw Blvd, Los Angeles.*

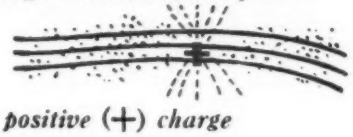


Precipitron KEEPS THESE ELECTRICAL GIANTS FROM "RUNNING A TEMPERATURE"

A NEW PRINCIPLE FOR CLEANING AIR

Dirt, smoke and soot—

passes through an electrostatic field



receives a positive (+) charge

and is drawn to a collection plate of opposite polarity (—)

where it remains until flushed down the drain.

Small particles of air-borne dirt can damage the largest rotating electrical machinery, causing shutdowns and expensive repairs. Temperature rises may result from excessive dirt on the windings; threat of fire is increased, electrical breakdowns are more probable.

Precipitron*—the Electronic Air Cleaner—effectively overcomes these dangers to uninterrupted operation by removing more than 90% of the dirt and other foreign particles in the circulating air. So efficient is this electronic method of cleaning air that particles less than 1/250,000 of an inch in diameter are removed. No other method can give this assurance of thoroughness and protection.

Westinghouse Engineers will be glad to give you full details of how Precipitron can improve machine operation in your plant. Just phone your nearest Westinghouse Office. Or write Westinghouse Electric & Mfg. Company, Dept. 7-N, East Pittsburgh, Pa.

J-04006

* Trade-mark registered in U. S. A.

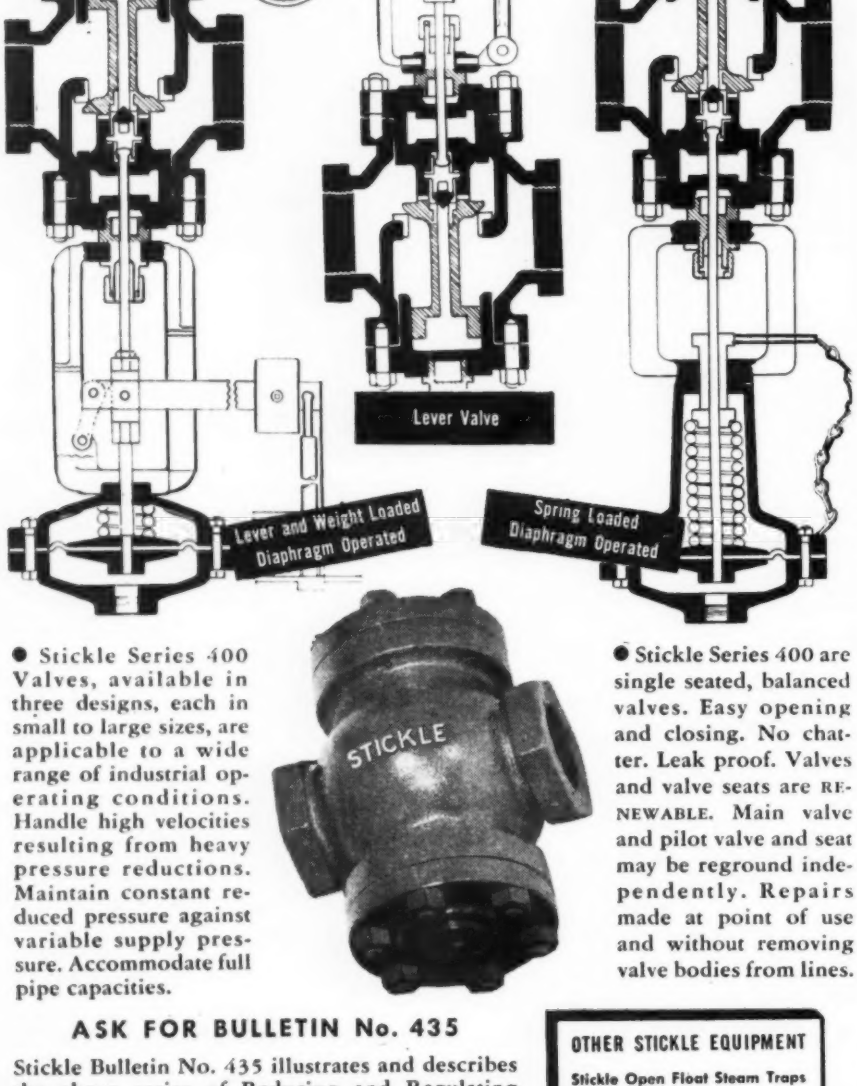
Westinghouse Precipitron *the Electronic Air Cleaner*

PLANTS IN 25 CITIES OFFICES EVERYWHERE

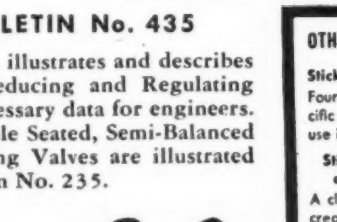
STICKLE VALVES

REGULATING—REDUCING, SERIES 400

Accurate...Sensitive...Dependable



● Stickle Series 400 Valves, available in three designs, each in small to large sizes, are applicable to a wide range of industrial operating conditions. Handle high velocities resulting from heavy pressure reductions. Maintain constant reduced pressure against variable supply pressure. Accommodate full pipe capacities.



● Stickle Series 400 are single seated, balanced valves. Easy opening and closing. No chatter. Leak proof. Valves and valve seats are RENEWABLE. Main valve and pilot valve and seat may be reground independently. Repairs made at point of use and without removing valve bodies from lines.

ASK FOR BULLETIN No. 435

Stickle Bulletin No. 435 illustrates and describes the above series of Reducing and Regulating Valves and supplies necessary data for engineers. Stickle Series 200, Double Seated, Semi-Balanced Reducing and Regulating Valves are illustrated and described in Bulletin No. 235.

OTHER STICKLE EQUIPMENT

Stickle Open Float Steam Traps
Four series designs to meet specific operating conditions. Specify use in requesting bulletin.

Stickle Differential Drainage and Boiler Return System
A closed pumping system for increasing boiler capacity and reducing fuel cost. Bulletin No. 250.

Stickle Open Coil Feed Water Heaters and Purifiers
Heat more water in less space. Trouble free. Deaerating and non-deaerating types. Ask for Bulletin No. 117.

Stickle

STEAM SPECIALTIES COMPANY

2265 VALLEY AVENUE • INDIANAPOLIS, INDIANA

Power News

(*Continued from page* 130)

program which by next July will have totaled 1,356,569 kw, much of it in small, portable units.

First of the power trains was assigned by Russia to the Donets Basin. Numerous Russian industries were moved deep into Russia in face of the German advance to prevent them from falling into Nazi hands. In August, 1941, the Russians destroyed essential parts of Dneiprostroy dam to prevent its use by the Germans. Nazis completed wreckage of the dam as they withdrew from the Ukraine, and Russians moved many of their industries back to the area to be near materials sources and near point of consumption.

Reconstruction of Dneiprostroy dam cannot be considered as a war project because of the time involved. At last report, Russian engineers were making tests to determine whether the dam's foundation could be salvaged.

Water-Flooding Project Increases Oil Production

Bureau of Mines' engineering survey reports an 87,000-barrel increase in oil production in 20 months for 41 oil wells in first systematic water-flooding project ever tried in an Illinois oil-producing limestone formation. Water-flooding is a method of secondary oil recovery in which water is pumped underground to force oil to the wells where it is brought to surface. Although tried previously with success in sandstone formations in that state, this water-flooding project marks the first attempt at flooding an Illinois limestone formation and is one of a few in the nation in limestone reservoirs..

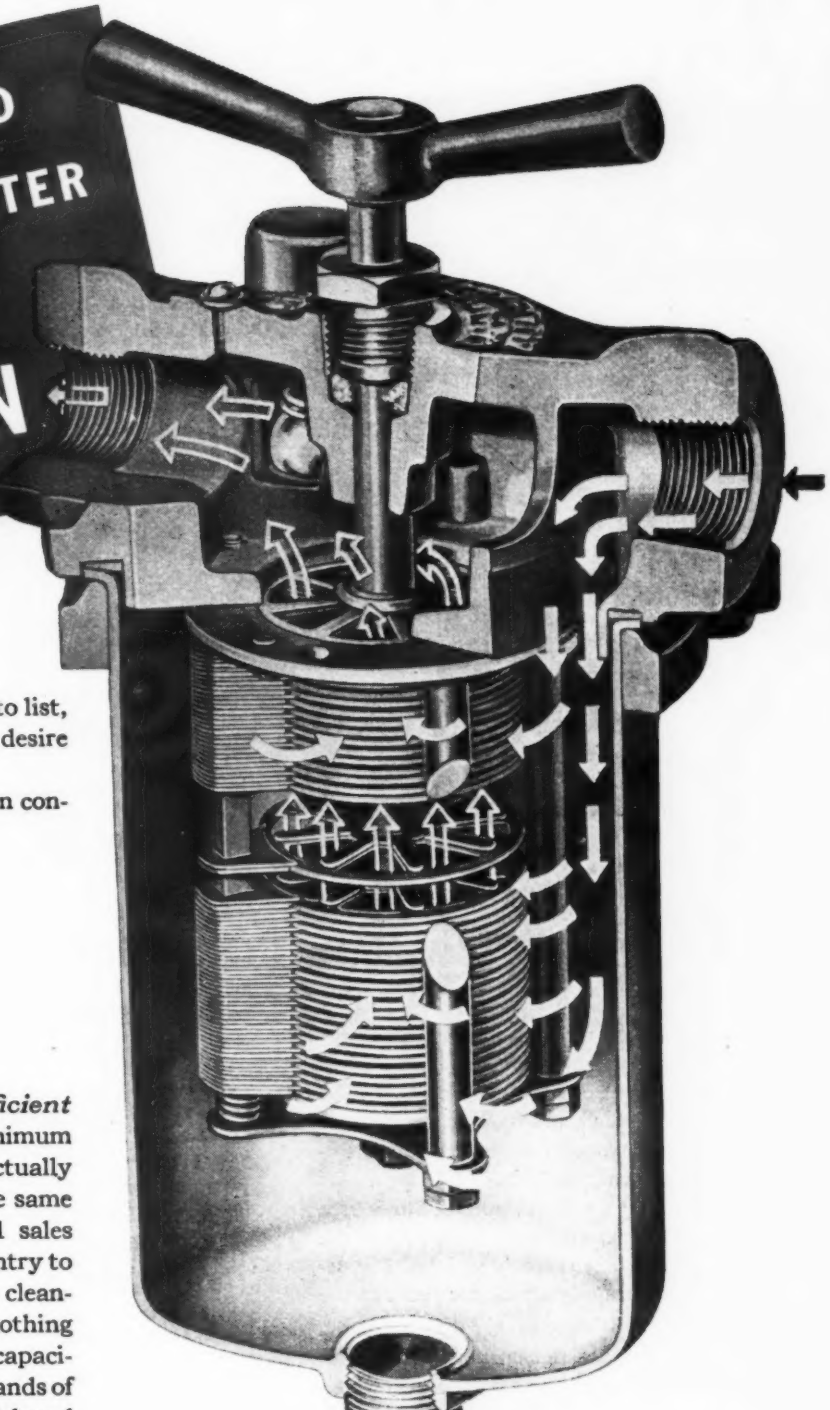
A copy of the survey, Report of Investigations 3792, *Water-Flooding of the McClosky Limestone in Clay City Oil Field, Clay County, Illinois,* may be obtained by writing the Bureau of Mines, Dept of Interior, Washington 25, D. C.

Tests Show Recoverable Washington Coal Deposit

As part of a program to alleviate wartime fuel shortages in the Pacific Northwest, Bureau of Mines has conducted tests showing that a lignite deposit in Lewis County, Washington, can be developed to furnish fuel for an industrial plant provided it is relatively near the coal bed. Although the area has not been explored fully, it seems probable that the deposit contains at least several million tons of recoverable coal. Limited exploration by private companies indicates that the lignite averages 40 ft. in thickness and the overburden about 43 ft.

The deposit is about nine miles east of

WHAT YOU'VE SAID YOU WANT IN A FILTER YOU GET IN AN AUTO-KLEAN



WE asked a large number of manufacturers to list, in order of importance, the features they desire most in a fluid-cleaning device.

Here's what the men in charge of production considered most important:

1. **Efficiency**
2. **Simplicity and compactness**
3. **Service from supplier**
4. **Ease of maintenance**
5. **Capacity**
6. **Continuous operation**
7. **Maintenance cost**

Now consider the Cuno Auto-Klean. (1) It's *efficient*—positively stops all solids larger than minimum size specified. (2) It's simple and *compact*—actually smaller in size than other filters handling the same volume at equal porosity. (3) There are 21 sales engineering organizations throughout the country to provide service. (4) It's easy to maintain—is cleanable just by turning a handle, or by motor—nothing to replace or remove for cleaning. (5) Flow capacities range from a fraction of a gallon to thousands of gallons per minute. (6) Production is never delayed—the filter is continuously cleanable without interfering with flow. (7) Maintenance cost is low because the all-metal filter element will last as long as the equipment on which it is installed.

Cuno Auto-Klean—an all-metal, non-collapsible filter—is being used successfully on a variety of applications . . . from high-pressure to gravity-feed systems . . . from straining river water to filtering heaviest fuel oil.

You'll find filter selection information and specifications on the Cuno Auto-Klean in SWEET'S—or write us for Mechanical and Process Industries Catalog, Cuno Engineering Corporation, 224 South Vine Street, Meriden, Connecticut.

KEEP FLOW ON "GO" WITH

CUNO

THE "FILTER-FINE" STRAINER

The SHAVE-OFF

Buell's assurance of
HIGH EFFICIENCY, LOW MAINTENANCE, LONG LIFE

SUCCESSFULLY utilizing the "double-eddy" current—an aero-dynamic phenomenon present in all cyclone-type collectors (established by van Tongeren)—Buell, and Buell *only*, effectively puts this force to work by an exclusive mechanical feature known as the "Shave-off". By means of this design feature, the important "fines" are collected and by-passed to the lower part of the cyclone where the downward flow of the "double-eddy" current automatically carries them to the dust discharge outlet.

In ordinary cyclones, this dust circulates under the top plate, finally dropping by gravity through the upward, rotating gas stream of the "double-eddy" current. Thus, in its passage to the dust discharge outlet, the "fines" become re-entrained in the gas flow and are partially lost through the gas outlet.

This exclusive feature of the patented Buell (van Tongeren) cyclone is a prime factor in Buell's well-known high recovery efficiency.

BUELL FEATURES

SHAVE-OFF
LARGE DIAMETERS
EXTRA-STURDY CONSTRUCTION
CORRECT HOPPER DESIGN
SPLIT-DUCT MANIFOLDS
INNER WELDS GROUND SMOOTH

RESULT IN

HIGH COLLECTION EFFICIENCY
LESS FAN BLADE WEAR
LOW DRAFT LOSS
LOW POWER CONSUMPTION
HIGH TEMPERATURE RESISTANCE
UNLIMITED CAPACITY
NO MOVING PARTS
FREE DUST FLOW

PRODUCE

HIGH EFFICIENCY
LOW MAINTENANCE
LOW OPERATING COST
LONG LIFE
NO CLOGGING

buell
DUST RECOVERY SYSTEMS

Convincing facts about the "Shave-off" may be found in Buell's bulletin—*"The van Tongeren System of Industrial Dust Recovery"*

BUELL ENGINEERING COMPANY, INC.
10 Cedar Street, New York 5, N. Y.
Sales Representatives in Principal Cities

DESIGNED TO DO A JOB, NOT JUST TO MEET A "SPEC"

Toledo, in Lewis County, and about 20 miles from Castle Rock, Cowlitz County. A high-grade clay deposit near Castle Rock recently was subjected to a detailed exploratory and laboratory-testing project by the Bureau as a potential source of alumina, from which aluminum metal is made. A processing plant for extracting alumina from the clay probably could utilize the lignite.

A copy of the publication, Report of Investigations 3795, *Preparation Tests of Lignite from a Deposit near Toledo, Lewis County, Washington,* may be obtained without charge from Bureau of Mines, Dept of Interior, Washington 25, D. C.

Bureau of Mines has selected a site on U. S. Naval Oil-Shale Reserves in western Colorado for a $1,500,000 oil-shale demonstration plant, one of the major installations authorized by Congress in the synthetic-liquid-fuels acts.

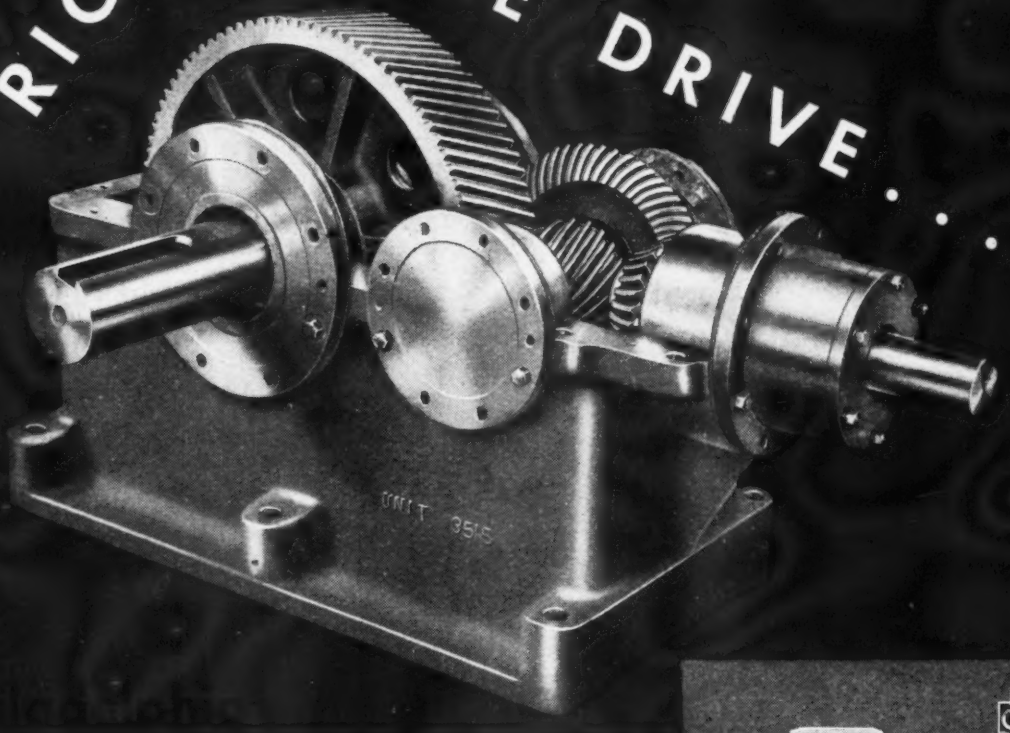
To be established in the Anvil Points area, about seven miles west of the town of Rifle, this plant will serve as a proving ground for processes being developed to convert the country's large reserves of oil shale into an auxiliary source of fuels and lubricants for the military forces and essential civilian economy. Built on government-owned land, it will be operated with an oil-shale research and development laboratory, which is to be built at Laramie, Wyoming, on a site donated to the federal government by the University of Wyoming.

Folder entitled *"What Are the Opportunities for College Men in the Diesel Engine Industry?"* points to jobs in diesel-engine factories in production, installation, maintenance and sales. Out in the field there is work in diesel operation in railroads, ships, stationary power plants, busses and trucks. The folder states that jobs for designers and researchers will, for the most part, be open to engineers with master's and doctor's degrees. Best training to equip a graduate engineer for the diesel industry is a well-grounded course in mechanical-engineering fundamentals. Diesel Engine Manufacturers Assn, 1 North La Salle St, Chicago 2, Ill., distributes this folder to all members of the diesel manufacturing industry as well as to all engineering schools.

James F Lincoln Arc Welding Foundation announces an award program to encourage preparation and publication of textbooks, one on machine design and another on structural design for fabrication by all processes, including welding. Also eligible are revisions of existing textbooks in these fields. Further details of this new project for textbooks, which closes May 15, 1946, may be obtained by addressing The Secretary, James F Lincoln Arc Welding Foundation, Cleveland 1, Ohio.

To encourage the preparation of outstanding papers on resistance welding, the Resistance Welder Manufacturers Association, Philadelphia, is again conducting a prize contest with total awards of $1,000. One prize is set at $500, two at $200 each and another at $100. Write to the association at 850 Euclid Ave, Cleveland 14, for further details.

a HIGH EFFICIENCY RIGHT ANGLE DRIVE . . .

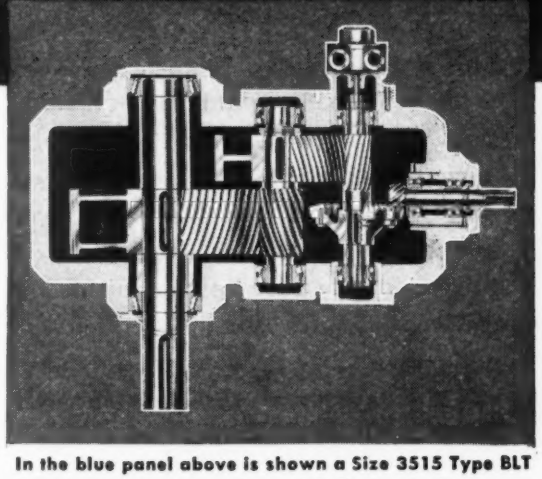


Spiral-Bevel Speed Reducers

These units provide a dependable means of transmitting power at right angles, either horizontally or vertically. They're made in single, double and triple reductions with standard ratios ranging from 1.5 to 1 up to 238 to 1. The single reduction units employ only spiral bevel gears, while in the double and triple reduction types helical gears are used for the second and third reductions.

An outstanding advantage of Philadelphia Spiral Bevel Reducers is the high efficiency rating, for example, the single reduction unit is approximately 98% efficient. That means all but 2% of the input power is transmitted to the low speed shafts . . . thus often smaller frame size motors can be used with spiral bevel units than with other comparable types of reducers.

Our Bulletin 200 gives further details . . . a copy will be gladly sent in reply to a request on your business letterhead.



In the blue panel above is shown a Size 3515 Type BLT Double Reduction Spiral Bevel Helical unit. The lower illustration is a sectional view of a Triple Horizontal Unit, Size 3600 Type BLT.

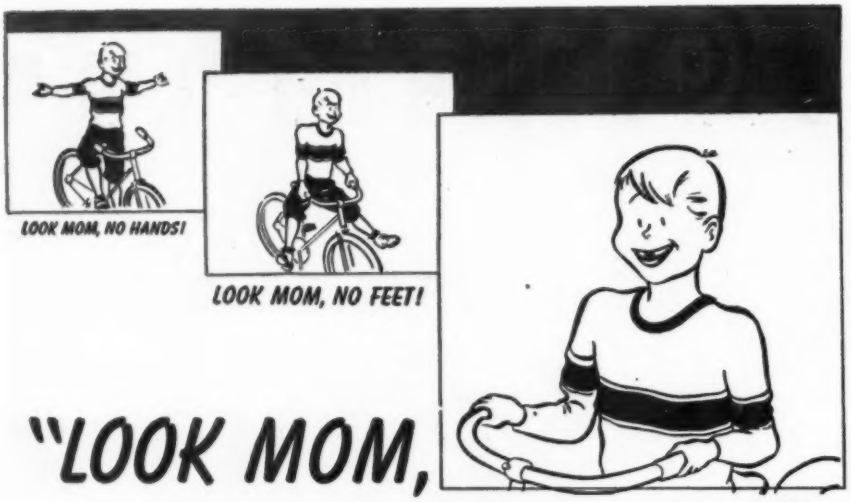
Philadelphia Spiral Bevel units are performing satisfactorily in many types of service.

ARMY E NAVY

Philadelphia GEAR WORKS INCORPORATED

ERIE AVE. AND G ST., PHILADELPHIA 34, PA. NEW YORK • PITTSBURGH • CHICAGO

Industrial Gears and Speed Reducers
LimiTorque Valve Controls



"LOOK MOM, NO TEETH!"

This is no joke. To Mom it is serious. And to you also "no teeth" is an important matter, if you use pressure gauges. Now you can get Certified Gauges with the new, patented Helicoid Movement and that means no teeth to wear out.

After serving in the Navy for several years, Certified Gauges are now available to industry for prompt delivery.

If you've had gauge trouble due to movements wearing out or getting sticky, investigate Certified. Try one on some really tough service. See for yourself how much longer they wear and remain accurate. Ask the man who uses them.

Only Certified Gauges are made with the Helicoid Movement. All Certified Gauges are guaranteed accurate to within ½ of 1%. Send for catalog today.

Certified GAUGE
AND INSTRUMENT CORP.

34-38 Northern Boulevard Long Island City 1, New York

Technicolor sound motion picture, *Magic Wand of Industry—Arc Welding*, released by Lincoln Electric Co portrays progress of arc welding from its beginning to present wartime role. There are also scenes which take the audience into the welding world of tomorrow. Produced at request of U. S. Bureau of Mines, which is releasing the picture under the title *A Story of Arc Welding*, this 25-min presentation, filmed under technical direction of Lincoln welding engineers, was staged and photographed in practically every major industry. Film is available at no charge except transportation from the Lincoln Electric Co, 12818 Coit Rd, Cleveland 1, O., or from U. S. Bureau of Mines, Experimental Station, 4800 Forbes St, Pittsburgh, Pa., in 16 and 35 mm prints.

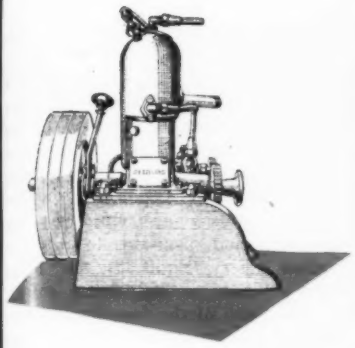
The Navy has loaned Jacksonville, Fla., a mobile 10,000-kw boiler and generator unit to help the city meet unprecedented demands for electric power. The equipment, valued at $2,000,000, was shipped to Jacksonville from Philadelphia and Institute, W. Va. Pending complete installation of the mobile unit, the city has asked large users of electric power to cut electric consumption as much as possible.

Battelle Memorial Institute plans expansion of its research education, which will be of special interest to veterans who can qualify for training as research workers in the sciences. The program, which will be directed at the graduate level of education, is an expansion of the plan which has been markedly successful thus far with Ohio State University.

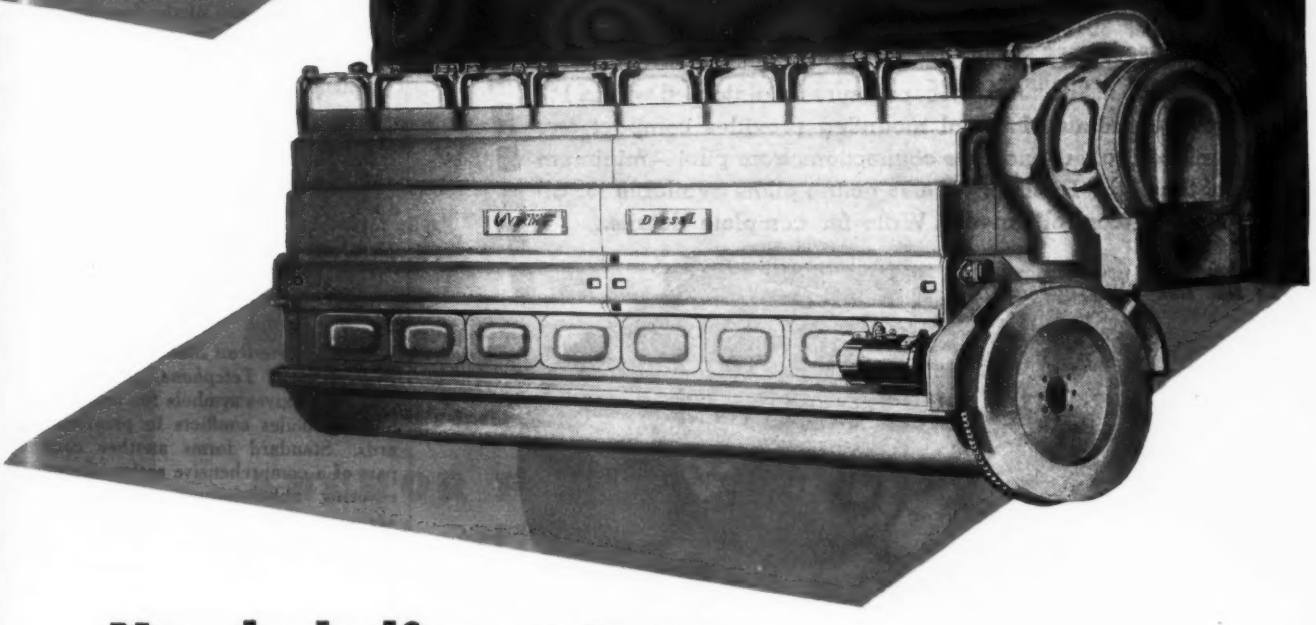
War Production Board has authorized three new steam-generating units in Illinois. A 100,000-kw unit with two 1250-psi boilers will be installed in the Calumet plant of Commonwealth Edison Co, Chicago. Two 40,000-kw machines are to go in a new Illinois Power Co station at Havana, with three boilers and other equipment required to put the station into operation to feed the 138-kv Illinois Power system.

Soren H Mortensen, chief electrical engineer of **Allis-Chalmers Mfg Co,** receives the 1944 Lamme Medal of **American Institute of Electrical Engineers.** This medal is awarded annually to a member in recognition of high achievements in development of electric apparatus or machinery.

University of Louisville Institute of Industrial Research, Louisville, Ky, engages in engineering and scientific research for industrial and private clients on a contract basis. Institute is the outgrowth of the Division of Industrial Research in the Speed Scientific School, which during the past few years has carried on limited contract research for industry. New organization, in addition to employment of a small permanent technical staff from different scientific and technical fields, depends for assistance in supervision on selected staff members of engineering and scientific faculty. Research work will be carried on by graduates. Dr R C Ernst is director and vice-president, Dr E W Jacobsen, chairman of board of managers, and F L Wilkinson, Jr, president.



DIESELS *by Sterling*



Nearly half a century of engine building experience —ready for you now!

In the new Viking Diesel, Sterling presents the advanced-design engine of tomorrow—a stationary power plant backed by nearly half a century of engineering experience. Covering a wide range of job applications for continuous duty or stand-by service, there are six and eight cylinder models—supercharged and unsupercharged—from 275 to 650 horsepower. Light weight, unusual compactness, operating economy and job adaptability are features fully explained in the illustrated engineering data we would like to send you. Outline your power requirements. Orders accepted now for early delivery.

★ *Other Sterling engines—gasoline, gas, butane and Diesel, from 85 to 1800 horsepower—are also available.*

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STERLING ENGINE COMPANY, 1271 NIAGARA ST., BUFFALO 13, N. Y. *Offices in New York, Washington and Chicago*

DEPENDABILITY PLUS WIZARD PRESSURE PILOTS WITH

FOR PUMP GOVERNOR SERVICE
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PRESSURE REDUCING SERVICE

Simple in design yet dependable and accurate — controlled pressures maintained within 1% plus or minus. Integral mounting provides compact one unit controller—no pipe connections from pilot—minimum of time lag. Direct or reverse acting pilots available for all sizes of control valves. Write for complete details.

FEATURING

1. Thumb screw adjustment of throttling range — 1% to 75% of tube range.
2. Vernier screw adjustment for setting controlled pressure.
3. Highly sensitive Bourdon tube of bronze or steel for various pressures.
4. Pilot assembly an integral part of diaphragm casing.
5. Weather proof mounting for gauges — indicate operating medium pressure and pressure on the diaphragm.
6. Auxiliary operating medium regulator standard equipment.
7. Controlled pressure connection with auxiliary tapping for gauge mounting.

FISHER GOVERNOR COMPANY
1025 Fisher Bldg., Marshalltown, Iowa

New training course with slide sound films, lesson books, quiz book and an instructor's manual sets forth in a clear and understandable manner how welding processes differ, how electronic control for resistance welding works and how this method of control extensively adapts this welding process to industry. Although produced primarily for Westinghouse employes, material has been made available to others at reproduction costs. Eight to ten hours should be allowed for full 7-part course, two hours for each of the four lessons.

Union Electric Co. of Missouri contemplates a $100,000,000 postwar construction program. Tentative plans call for expenditure of $45,000,000 for replacements and new facilities from 1945 to 1950, with remainder of $55,000,000 to be spent in succeeding five years. First step, subject to war and power demands, is enlargement of the Venice, Ill., generating plant so as to increase capacity from 200,000 to 320,000 hp.

Revised *American Standard for Graphical Symbols for Telephone, Telegraph and Radio Use* gives symbols for new apparatus and reconciles conflicts in previous standards. Standard forms another completed part of a comprehensive series of standards covering abbreviations and symbols for various engineering and scientific fields. Standards Z32.5-1944 may be obtained from American Standards Association, 70 E 45th St, New York 17, N. Y., at 30¢ per copy. Quantity prices available on request.

J Mack Tucker, associate professor of mechanical engineering at University of Tennessee was appointed editor of *Refrigeration Abstracts,* a new publication of American Society of Refrigerating Engineers, as announced recently at ASRE 40th annual meeting in New York. New publication, recording current refrigeration publications of engineering and scientific value, will be useful to research men and others in many branches of refrigeration and allied sciences.

W G Murrin, president of British Columbia Power Corp, announces a broad plan for improvement and expansion of company's public services. This is expected to result in expenditures of $50,000,000 over a 10-year period. Phases of the project are: (1) $17,000,000 for completion of initial units of Bridge River hydroelectric project (2) $16,000,000 for accommodating subtransmission and distribution facilities to expanding needs of Vancouver (3) $14,000,000 for remodeling street car system on lower mainland and Vancouver Island, including provision for trolley busses (4) $3,000,000 for improvements to Vancouver and Victoria gas systems, and a new gas manufacturing unit at Victoria.

Howard N Walters has been appointed director of industrial development by B. C. Electric Railway Co. His duties will be to help industry find new products and to help new industries get started in areas served by company. He will also aid in program of conversion from war to peacetime production of industrial plants in company's territory.

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Milwaukee 2, Wisconsin	903 East Kilbourn Avenue
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New York 13, New York	100 Sixth Avenue, near Canal
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Pittsburgh 22, Pennsylvania	405 Penn Avenue
Portland 1, Oregon	1433 S. W. Front Avenue
San Francisco 7, California	156 South Park
Seattle 4, Washington	2207 First Avenue, South
St. Louis 3, Missouri	1407 Pine Street
Tulsa 4, Oklahoma	823 South Gary Place
Wilmington, California	524 North Avalon Boulevard

THE ANCHOR PACKING CO. TRADE A MARK

These NEW Catalogs, Booklets and Bulletins Are Yours for the Asking!

AIR CONDITIONING, HEATING REFRIGERATION AND VENTILATING

1 **HEATERS AND COOLERS**—American District Steam Co, N Tonawanda, N. Y. 12-page bulletin No. 35-76B on ADSCO heaters and coolers includes three new designs. Dimensions, capacity tables and list prices are given.

2 **FORCED-DRAFT BLOWERS**—L J Wing Mfg Co, 57 Seventh Ave, New York 11, N. Y. 8-page bulletin No. SW-1 covers turbine-driven and motor-driven forced-draft blowers and auxiliary turbines.

3 **VENTILATING AND DUCT FANS**—L J Wing Mfg Co, 154 W 14th St, New York 11, N. Y. 8-page bulletin No. F-9 describes ventilating and duct fans. Capacity tables, dimensions and engineering data are included.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ **AIR-HANDLING EQUIPMENT**—B F Sturtevant Co, Hyde Park, Boston 36, Mass. 199-page pocket-size catalog and engineering book, entitled "What We Make," contains description of complete line of air-handling equipment and its application in industrial systems.

CONTROLS, MECHANICAL

4 **THERMOSTATIC CONTROLS**—Westinghouse Electric & Mfg Co, P O Box 868, Pittsburgh 30, Pa. 20-page booklet describes seven bimetal thermostats for automatic control of temperatures up to 650 F.

5 **CONTROL DEVICES** — Lear, Inc, Piqua, Ohio. 24-page booklet, entitled "Lear Know-How," gives general information on Lear and its products.

6 **AIR CONTROL** — Electro-Mechanical Div, Manning, Maxwell & Moore, Inc, Bridgeport, Conn. 4-page folder presents the Ashcroft air control for shallow well pumps. Equipment photos are included.

ELECTRICAL EQUIPMENT

7 **PAPER-DIELECTRIC CAPACITORS** —General Electric Co, Schenectady 5, N. Y. 8-page bulletin No. GEA-4388 discusses new line of high-frequency paper-dielectric capacitors for blocking and by-pass applications.

8 **REVOLVING-FIELD GENERATOR** —Electric Machinery Mfg Co, Minneapolis 13, Minn. Single sheet presents the E-M revolving field ac generator.

9 **INSULATING VARNISHES**—John C Dolph Co, 168 Emmett St, Newark, N. J. 56-page booklet, entitled "Insulating Varnishes and Compounds," contains tables, charts and articles on insulating varnish problems.

MAINTENANCE AND SAFETY EQUIPMENT

10 **AIR-OPERATED TOOLS**—Ingersoll-Rand Co, 11 Broadway, New York 4, N. Y. Form No. 117, entitled "Air-Operated Tools for Maintenance, Construction, Demolition," shows the busy maintenance man, at a glance, the line of I-R air tools and portable compressors available for speeding up his work.

11 **RUBBER GLOVES**—B F Goodrich Co, Akron, Ohio. 4-page catalog section discusses industrial synthetic rubber gloves.

12 **AIR GUNS**—Trico Fuse Mfg Co, Milwaukee 12, Wis. Bulletin No. 40 presents Trico air guns for blowing chips, dust, dirt, kicking out finished parts, operating air-driven tools, etc.

PIPING, FITTINGS VALVES AND SPECIALTIES

13 **BLOWOFF VALVES**—Yarnall-Waring Co, Chestnut Hill, Philadelphia 18, Pa. 24-page bulletin No. B-432 covers Yarway blowoff valves for working steam pressures from 400 to 2500 psi.

14 **DETACHABLE FLANGES** — Packless Metal Products Corp, New Rochelle, N. Y. Instruction folder shows how to assemble Packless A-F detachable flanges on flexible metal hose.

15 **RETURN TRAP**—Sterling Engine Mfg Corp, Hyde Park 36, Mass. page bulletin No. 9-44 discusses the Ster ing closed condensate-return system.

16 **SPECIALTIES**—Industrial Div, J Zurn Mfg Co, Erie, Pa. 12-pa catalog No. 45 describes complete line tested devices for protection of operati equipment connected with piping syste in industrial, processing and power plant

17 **VALVES**—O C Keckley Co, 400 Madison St, Chicago 6, Ill. 40-pa 1945 catalog covers pressure-regulati valves, pump governors, temperature reg lators, relief valves, float valves, sel cleaning strainers, water gages, ga cocks, illuminators, steam traps, etc.

PRIME MOVERS AND ACCESSORIES

18 **MARINE DIESELS**—Joshua Hen Iron Works, Sunnyvale, Calif. 1 page booklet No. JHA-11 features Seri 50 marine diesel engines, six and eig cylinders, with a power range of 350 675 hp.

19 **STEAM CONDENSER**—Niagar Blower Co, 6 E 45th St, New Yor 17, N. Y. 1-page bulletin No. 99 furnishe a diagram of operation of the Niagar Aero steam condenser.

20 **BAROMETRIC CONDENSERS**—In gersoll-Rand Co, 11 Broadway, Ne York 4, N. Y. 8-page bulletin No. 90 covers disk-flow and ejector-jet barometri condensers.

(*Continued on page* 188)

HOW TO ORDER

Be sure to fill out, completely, one coupon for each piece of literature you order. (See sample below.) This gives your request authority and helps the manufacturer to address your copy completely. Readers who fail to prepare request blanks correctly may be disappointed under difficult postal conditions and limited quantities of bulletins available today.

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SOME INSIDE BOILER FACTS

The interior surfaces of this high pressure boiler have been coated with tough, durable, APEXIOR No. 1

The next time your boiler is down, compare how it looks with this one

When you coat the interior metal surfaces of your boiler with APEXIOR, here's what happens:

1. A film of safety seals the open structure of the boiler metal. This film of safety is corrosion-proof because it is non-metallic, therefore the present condition of the boiler steel is improved and maintained.
2. Dirt and scale do not adhere as tightly to APEXIOR as to bare metal, because any bond between scale-forming solids and APEXIOR is easier to break, as it is a purely mechanical, not a chemical bond.

APEXIOR NUMBER 1 is brush-applied, manually or by power-coater. High boiler pressures or ratings, or chemical treatment of boiler water, do not affect APEXIOR NUMBER 1. The total thickness of the coating is .0025". Heat transfer is not retarded.

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APEXIOR NUMBER 1 is recommended by boiler insurance companies. Steam turbines are being delivered to users with shafts and rotor bodies APEXIORIZED. The supplier of your turbine may be one of those following this procedure of added protection.

So when you're thinking in terms of higher production and maintenance standards, start with the heart of your plant, your boiler. APEXIORIZE it.

For "Cold-Wet" Metal Surfaces— APEXIOR No. 3

Wherever you have tanks or metal surfaces exposed to water or moisture at any temperature under 125°F.— protect them with APEXIOR NUMBER 3. This special, shiny-black paint on metal is resistant to cold water, fresh or salt.

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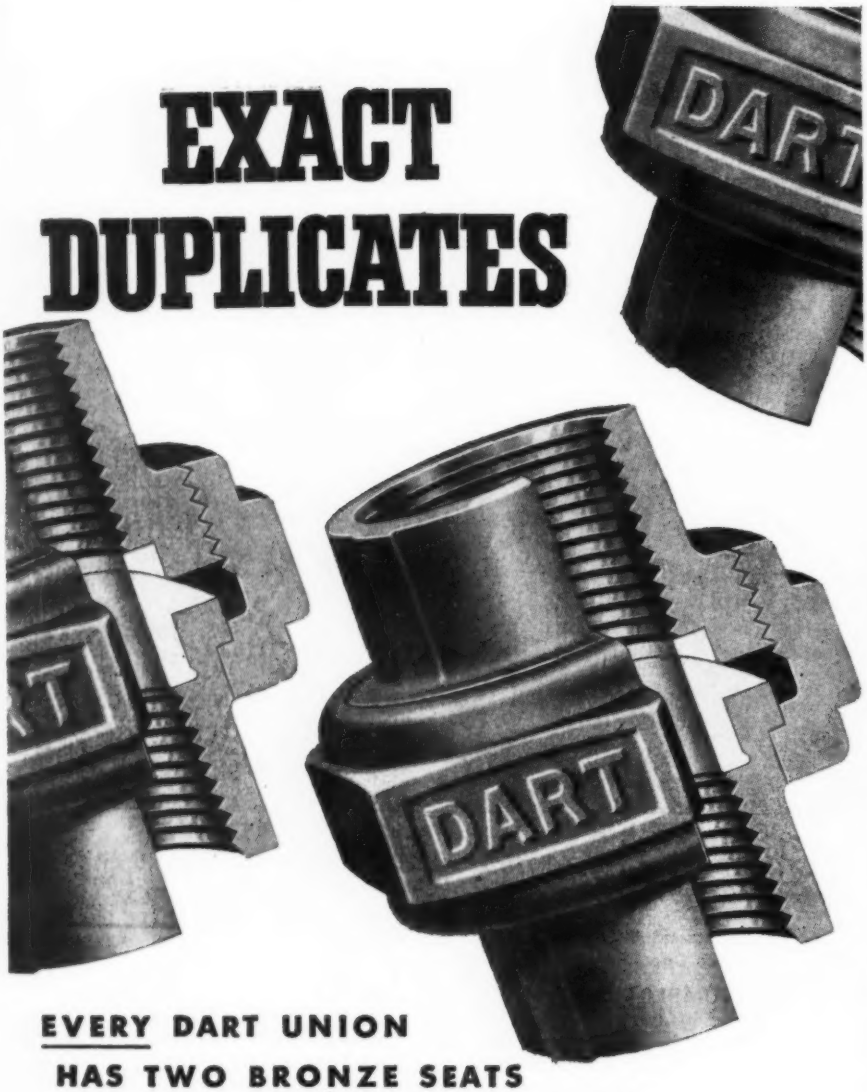
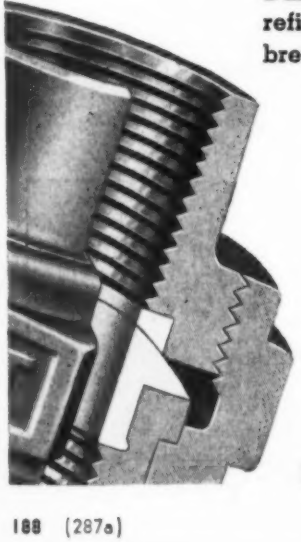


EVERY DART UNION
HAS TWO BRONZE SEATS
PERFECTLY GROUND TO FORM
A TRUE BALL JOINT

Every Dart closes to form a leak-proof, true ball joint. *Every* Dart will keep this perfect seat indefinitely, yet be ready to move instantly whenever you have a new job for it.

Dart bodies and nuts are made of high-test air refined malleable iron — are practically unbreakable.

That is why economy-wise buyers *standardize* on Darts.



DART
UNIONS

E. M. Dart Manufacturing Co. Providence, R. I.

New Bulletins

(*Continued from page* 186)

21 **STEAM CONDENSER** — Contract Engineering, 1024 Russ Bldg, San Francisco 4, Calif. 4-page folder introduces the Dawes condenser, which is said to offer great economies of space, weight and maintenance, as well as double the capacity of conventional smooth-tubed condensers of equal tube area.

22 **JET EJECTORS**—Graham Mfg Co, 415 Lexington Ave, New York 17, N. Y. 36-page bulletin No. 56 describes steam jet ejectors and thermo-compressors. Photographs and curve diagrams are included.

23 **HEAT EXCHANGERS**—Graham Mfg Co, 415 Lexington Ave, New York 17, N. Y. 20-page bulletin No. 58 describes construction, operation and application of Heliflow exchangers.

PUMPS

24 **JET PUMPS**—Berkeley Pump Co, Berkeley, Calif. 6-page bulletin No. 501 describes construction and operation of Berkeley 2-stage deepwell jet pumps.

25 **CENTRIFUGAL PUMPS** — Marlow Pumps, Ridgewood, N. J. 20-page handbook, entitled "Self-Priming Centrifugal Pumps," sets forth in easy-to-understand style the principles of centrifugal action, physics of pumping and evolution of self-priming centrifugal pumps.

26 **SEWAGE EJECTOR** — Yeomans Brothers Co., 1433 N Dayton St, Chicago 22, Ill. 12-page bulletin No. 4402 describes the Expelsor sewage ejector for pumping sewage and drainage with compressed air or steam.

27 **STEAM-JET EJECTORS**—Ingersoll-Rand Co, 11 Broadway, New York 4, N. Y. 8-page bulletin No. 9013 covers steam-jet ejectors for producing vacuum or removing air, gas and vapor from vacuum equipment.

28 **PUMPS**—Geo D Roper Corp, Rockford, Ill. 32-page booklet, entitled "How to Solve Pumping Problems," outlines basic fundamentals used in estimating requirements of average pumping job.

29 **DEEPWELL PUMPS** — Pump Div, Byron Jackson Co, P O Box 2017 Terminal Annex, Los Angeles 54, Calif. 12-page bulletin No. 44-5000 presents three deepwell pumps having more than 100 impeller designs, each with different hydraulic characteristics.

WATER TREATMENT

30 **ZEOLITE SOFTENERS** — Cochrane Corp, 17th St below Allegheny Ave, Philadelphia 32, Pa. Booklet No. 2860-A describes greensand zeolite softeners for production of soft water.

31 **FEEDWATER TREATMENT**—Cochrane Corp, 17th St below Allegheny Ave, Philadelphia 32, Pa. 4-page reprint No. 37 discusses feedwater treatment for high-pressure boilers at Dow Chemical Co.

32 **FEEDWATER TREATMENT**—K A T Corp, 331 Madison Ave, New York 17, N. Y. 12-page booklet, entitled "Internal Feed Water Treatment of Locomotive Boilers," explains current methods of preventing scale and corrosion. This article is part of the proceedings of the Master Boiler Makers' Association.

OTHER EQUIPMENT

33 **BOILER TUBES**—Bissett Steel Co, 947 E 67th St, Cleveland, Ohio. 4-page folder presents Bisco line of seamless steel boiler tubes.

34 **SPREADER STOKER**—Johnston & Jennings Co, 877 Addison Rd, Cleveland 14, Ohio. 4-page bulletin No. 441-S describes the newly introduced J & J spreader stoker.

1,250,000
Pounds of Steam Per Hour
FOR PHILLIPS PETROLEUM CO.'S BORGER, TEXAS
BUTADIENE PLANT

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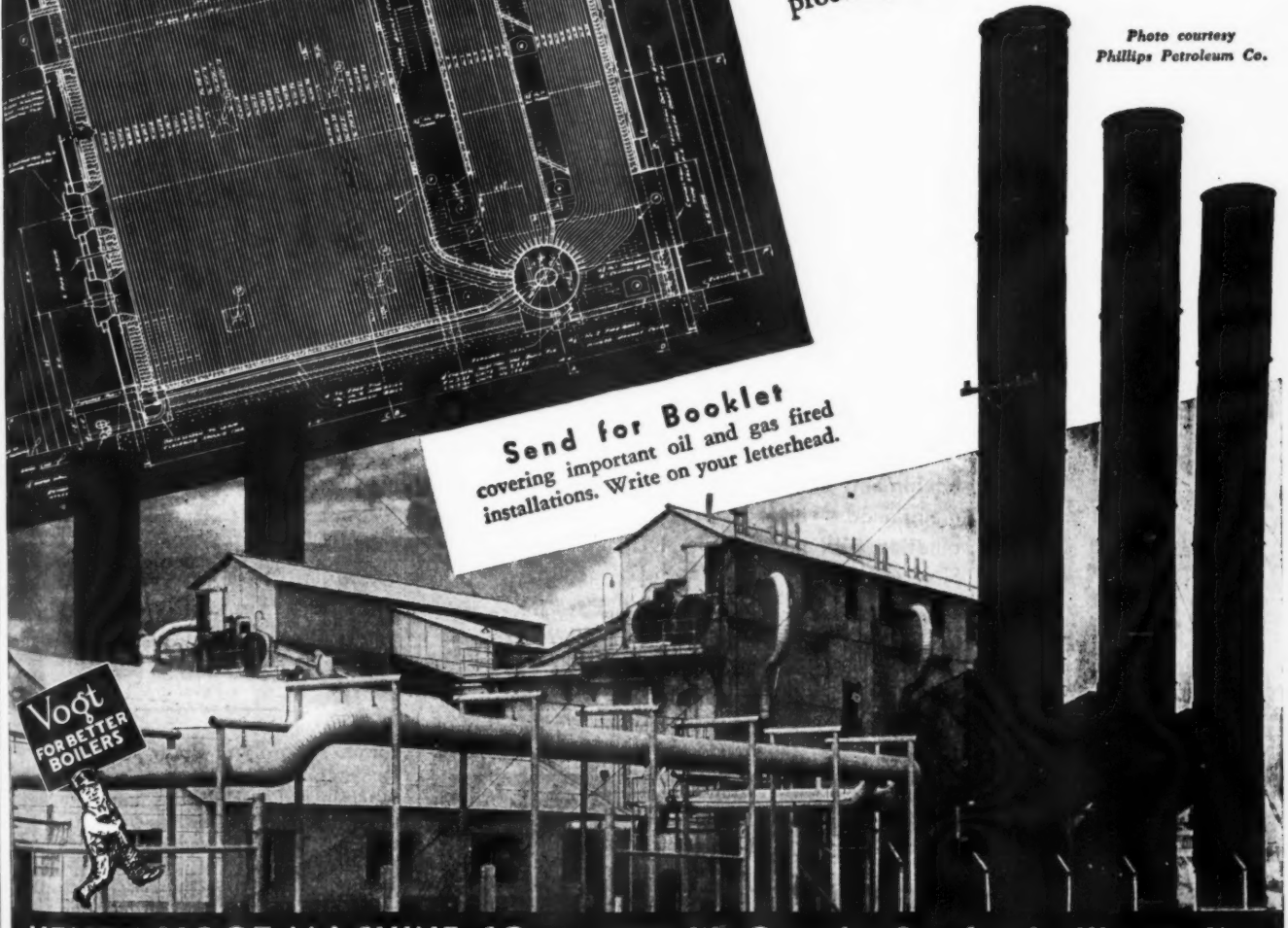
Five Vogt Class VR Steam Generators

provide 1,250,000 pounds of steam each hour for the production of butadiene, so vital to America's synthetic rubber program. The steam is used directly in process and for prime mover power with exhausts for process purposes.

Photo courtesy Phillips Petroleum Co.



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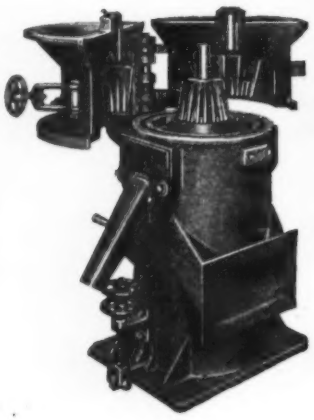

BUT NOW YOU CAN CRUSH AND SAMPLE

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Automatic

CRUSHER *and* SAMPLER

Times change! It used to be ok to have one or two men devote hours to "sampling" a pile of coal. But today you can get BETTER results — FASTER — delivered to your laboratory by the Sturtevant Equipment shown here. This is MODERN equipment. It meets the modern demand for a better quality coal to meet the increasingly SPECIFIC requirements of modern plants. The FIRST STEP in laboratory-control of coal QUALITY is to get accurate samples quickly and at low cost. This the Sturtevant Coal Crusher and Sampler does without hand labor. Proven by the test of actual service in modern collieries. Can be depended upon as reliable equipment. Simple, rugged, easily adjusted and maintained — and ACCURATE. The ideal combination with this Sampler is the STURTEVANT FINE GRINDER.

(Refer to our "AD" in the August Issue of Power—Page 209)

HERE IS THE IDEAL COMBINATION TO SPEED LABORATORY CONTROL AND INSURE RESULTS !

Investigate the "STURTEVANT WAY"— NOW!

Send at once for illustrated booklet containing valuable information on coal sampling and the big accomplishments realized in leading plants through using "STURTEVANT" automatic method.

Sturtevant Mill Co.

103 Clayton St., Dorchester, Boston 22, Mass.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

PAINT—Arco Co, Cleveland, Ohio. 16-page color selection guide permits persons without detailed technical understanding of color science to specify correct color shades that minimize fatigue and promote safety. This publication is available to executives only.

35 CRACKED BLOCK REPAIR—Moguloid Co of America, 1503 W Van Buren St, Chicago 7, Ill. 4-page bulletin No. 22 explains the Moguloid process for repairing cracked cylinder blocks.

36 HAND TACHOMETERS — Herman H Sticht Co, 27 Park Pl, New York 7, N. Y. 4-page bulletin No. 760 describes the Model J triple-range hand tachometers of centrifugal design.

37 METERS AND INSTRUMENTS—James G Biddle Co, 1211 Arch St, Philadelphia 7, Pa. 32-page brochure, entitled "Report at Mid-Century," depicts history of the company from its beginning to the present.

38 METAL—Meehanite Research Institute of America, Inc, Pershing Square Bldg, New Rochelle, N. Y. 127-page bulletin, entitled "Stories of Meehanite in Industry," consists of a collection of articles on Meehanite castings which have appeared in various trade publications.

39 BELTING—Baldwin Belting, Inc, 85 Chambers St, New York 7, N. Y. Chart provides a rapid reference for standard belt thicknesses and includes full information as to fastener and lacing sizes for each thickness.

40 SHAFT COUPLINGS—Link-Belt Co, 307 N Michigan Ave, Chicago, Ill. 8-page book No. 2045 covers complete line of shaft couplings. Sizes, dimensions and list prices are included.

41 CONVEYORS—Chain Belt Co, 1600 W Bruce St, Milwaukee 4, Wis. 6-page bulletin No. 462 describes Rex apron and pan feeders and conveyors. Design details, cross sections, capacity tables and specifications are given.

42 WELDING RODS—Eutectic Welding Alloys Co, 40 Worth St, New York 13, N. Y. 6-page folder discusses Eutectic low-temperature welding rods for repair and maintenance.

43 WELDING—Mir - O - Col Alloy Co, 2416 E 53rd St, Los Angeles 11, Calif. 36-page booklet, entitled "Weldors Guide to Successful Hard Facing," sets forth the result of 20 years of research and successful application of hard facing.

44 VIBRATION CONTROL — Korfund Co, 48-15 32nd Pl, Long Island City 1, N. Y. 4-page bulletin No. SL500 presents the Korfund SL Universal Vibro-Isolator. This booklet contains complete data on rated loads, weights and dimension in the six basic sizes.

45 ADHESIVE SHEET—Charles Bruning Co, 4754 Montrose Ave, Chicago 41, Ill. 6-page leaflet describes Dulseal, a tissue-thin transparent film for protecting, preserving and repairing tracings, drawings, prints, charts, sketches, etc.

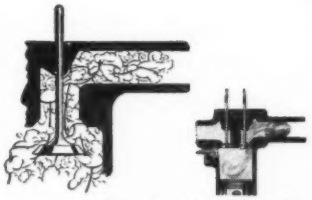
46 ADJUSTABLE TRIANGLE—Charles Bruning Co. 4754 Montrose Ave, Chicago 41, Ill. 6-page leaflet discusses the Bruning adjustable triangle No. 2598A for all kinds of layout work.

Nation's supply of vitally needed welders for naval armament has been augmented by 318 men and women who have completed the course and qualified as first-class Navy welders at welding school of Rust Street gun-mount plant of Babcock & Wilcox Co, Alliance, Ohio. Since its beginning in Dec, 1940, the school has given 85,000 man-hours of instruction and taught welding to 398 students.

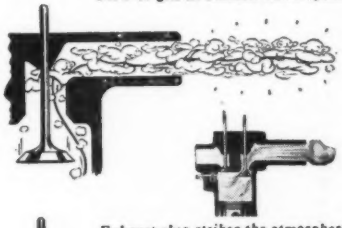
ORIGINATORS OF SNUBBING PRINCIPLE FOR QUIETING DIESEL EXHAUSTS—BURGESS—ORIGIN

BURGESS SNUBBER BULLETIN for Diesel Exhaust Noise Control

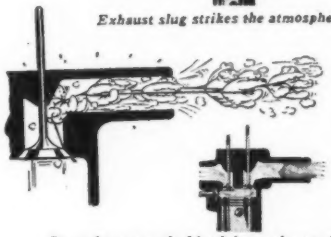
HOW REVERSE FLOW OF EXHAUST GASES CAUSES NOISE AND INCOMPLETE SCAVENGING



Flow of gas as exhaust valve opens.



Exhaust slug strikes the atmosphere.



Burned gases sucked back into exhaust pipe.

While engineers usually think of exhaust gases as flowing in an outward direction only, the truth is that there is a two-way flow when no Snubber is used to check it. There is a surge outward every time an exhaust valve opens, then a considerable reverse flow of gas back toward the cylinder after the cylinder has been emptied. The violent oscillation of the exhaust gases has been drawn in cartoon form. At the right of each cartoon is a picture of this gas movement as it actually takes place during a portion of the engine cycle.

The first picture shows how the gases surge out of the exhaust port as soon as the valve opens. Because of the extremely high pressure within the cylinder, these gases are accelerated very rapidly and shoot out of the exhaust pipe with great force. The main body of gases, traveling at high velocity and under high pressure, is known as the exhaust "slug." The action as the "slug" leaves the exhaust pipe is shown in the second drawing. Most of the gases shoot out of the exhaust pipe and very little gas is left in the cylinder. The result is that a relatively high vacuum is created in the cylinder and in the exhaust line close to the valve.

When this vacuum has become great enough to overcome the momentum of the slug, exhaust gases, together with some air around the end of the exhaust pipe, are sucked back into the pipe. If this occurs during the period the exhaust valve remains open, the cylinder will again be filled with burnt gases. Thus, on a two-cycle engine it might be found that the supply of fresh air is contaminated with burnt gases and the engine would be inefficient or might fail to run.

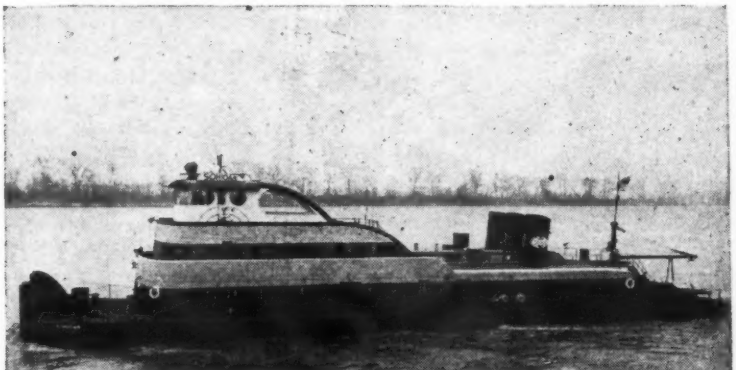
Noise Caused by Two-Way Flow

This two-way flow takes place in any exhaust pipe not equipped with a Snubber. It explains the difficulty of obtaining adequate silencing with old style "mufflers." Such devices do not prevent the reverse flow, and it is necessary to tune the exhaust system so that the reverse flow will not interfere with efficient engine operation.

No tuning is necessary where a Burgess Snubber is installed. The exhaust slug is "snubbed"—that is, it is slowed down and dispersed—so that there is no reverse flow to cause trouble and incomplete scavenging. Exhaust gases leave the tail pipe of the Snubber in a quiet, even flow.

This two-way flow of gases is also responsible for a large part of the exhaust noise. Exhaust gases, passing down the pipe as each slug leaves the engine, strike the atmosphere making a sharp sound similar to that of a toy pop gun. This is followed by oscillation in the pipe line causing a low pitched roar. Thus, "snubbing" the exhaust slug eliminates the cause of exhaust noise, stopping both the "pop" of the outward flow and the accompanying roar.

* * *



SOHIOAN—One of the newest towboats on the inland waterways and, undoubtedly, the most modern and streamlined in the country, is the Standard Oil Company of Ohio's "Sohioan." In addition, it is the most powerful Diesel towboat on the river, having three Fairbanks-Morse Diesel engines, each developing 805 hp. at 300 rpm.

Since the "Sohioan" incorporates a number of new design features to obtain the greatest amount of power that is practicable in an engine hull, a 10-ft. model was first given thorough tests which proved the efficiency of the new design before the towboat itself was built.

The interior of the boat, as well as the engineering construction, is as modern as its appearance with top quality equipment used throughout. In order to assure crew comfort, the engine room ceiling is covered with fireproof acoustic panels and acoustic blanket to minimize engine noise, and all three main engines are equipped with Burgess Snubbers to eliminate exhaust noise nuisance.

HELPFUL HINTS

Avoid the use of flat-sided or thin-walled conduit for exhaust gases

The seemingly unimportant question of what kind of pipe to use to carry exhaust gases from the engine to the Snubber is really a big factor in quiet operation, in order to be sure that vibration and noise are not caused by the wrong kind of pipe. Where the wrong kind of pipe is used, the Snubber is sometimes blamed for noise which is really "pipe noise."

Flat-sided conduits, for example, should never be used. The sides of such rectangular pipes, even when they may seem heavy or rigid, vibrate like diaphragms in tune with the oscillation of the exhaust gases. Not only does this vibration cause "pipe noise," but it may become extreme enough to cause joints to open or the pipe itself to fail in service.

Spiral-welded pipe, or any other pipe which has thin walls, should be avoided when used for exhaust pipe. Such a pipe will "talk" or "sing," causing a great deal of noise which can be completely avoided by using heavier pipe. Once exhaust gases pass through the Snubber, however, their flow is smoothed sufficiently so that any pipe of sufficient mechanical strength can be safely used for a tail pipe.

Published by BURGESS-MANNING COMPANY Chicago, Illinois

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RIGINATORS OF SNUBBING PRINCIPLE FOR QUIETING DIESEL EXHAUSTS—BURGESS—ORIGI

REX-WELD

KING OF FLEXIBLE METAL HOSE!

There are reasons for leadership in every line. Better performance, finer quality, greater versatility and dependability . . . these and many more have given REX-WELD Flexible Metal Hose the high reputation it has today. A reputation that has earned the confidence of industry everywhere. Industrial men know the advantages of REX-WELD. For this rugged, seep-proof, airtight product has been outperforming ordinary connections on a wide variety of applications throughout industry.

Let "Flexon," the C. M. H. trademark character, show you in the sketches below some of REX-WELD'S outstanding features. Then ask us to give you the full story about REX-WELD and the other flexible metal hose products in our complete line.

REX-WELD . . . stands up under terrific flexation, vibration and strain. Its heavier, more uniform wall structure gives it greater strength, longer life.

REX-WELD . . . handles steam with utmost safety. It is seep-proof to gas, oil, water and searching fluids. It is highly rust-resistant and non-deteriorating.

REX-WELD . . . operates efficiently under pressures up to 5,000 p.s.i., temperatures to 1000° F. Greater strength and durability are the result of its 50-50 principle of corrugation . . . of an autogenous welding process that makes the weld stronger than the tube itself.

REX-WELD . . . is available in bronze and steel in sizes from 3/16-in. to 4-in. I. D. (incl.), with annular or helical corrugations, braided or unbraided, depending on requirements. REX-TITE heatproof mechanical couplings are easy to install and are reusable.

Flexible Metal Hose for Every Industrial Use

ARMY (E) NAVY

CMH

CHICAGO METAL HOSE CORPORATION

MAYWOOD, ILLINOIS

Plants: Maywood and Elgin, Ill.

APPOINTMENTS

American Chain & Cable Co appoints **Alton Parker Hall** general manager of sales, with headquarters at 230 Park Ave, New York City. **Ralph J Teeple** has been made general district sales manager of New York district. **J J Walsh** becomes district sales manager of Page steel and wire div and William Wagner sales manager for Reading-Pratt and Cady div, both at 230 Park Ave . . . **Elliott Co,** tube cleaner div, has appointed **G L Elliott** as assistant to president. **Harold W Kealey** has been made director of personnel, in addition to his duties as assistant secretary . . . **O C Keckley Co** has made **C S Aspenwall** sales engineer in steam and liquid control div and **John M Davie** sales manager of hydraulic press div.

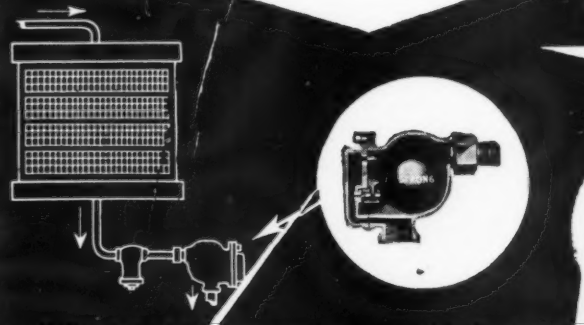
American Engrg Co buys **Cochrane Corp** and **Faraday Electric Corp. Percy S Lyon** continues to serve as president and director of Cochrane Corp and becomes a director of American Engrg Co. E I Kleinman, J M Doroshaw, J S Ackerman, Allison L Bayles and Thurlow E McBride, all officers of American Engrg Co, have been elected directors of Cochrane Corp. **Bailey Meter Co** appoints **R E Sprenkle** hydraulic engineer . . . **Cooper-Bessemer Corp** appoints **Walter F Myers** to Washington office staff . . . **General Controls Co** has made **A E Hess** manager of Houston branch office.

Westinghouse Electric & Mfg Co announces appointment of **Leonard C Blevins** to sales manager of meter div. **H L Buechner** becomes watthour-meter sales manager. **L G Burwinkel** has been made assistant to vice-president. **Gwilym A Price** and **John R Read** have been elected to board of directors. **Eric Hall** has been appointed New Jersey division manager, with offices in Newark, N. J. **Robert W Pritchard** has been made assistant to **Russell E Ebersole,** lamp sales manager. Former radio div of Westinghouse becomes industrial electronics div and former radio receiver div becomes home radio div. **Norman R Miller** has been transferred to Los Angeles where he will represent the company at shipyards and ship-repair centers in that area. **John F Myers** has been promoted to manager of Middle Atlantic district. **H C Lease** succeeds him as manager of Washington branch. **O A Redhair** has been appointed manager of accounting at transformer div plant in Sharon, Pa.

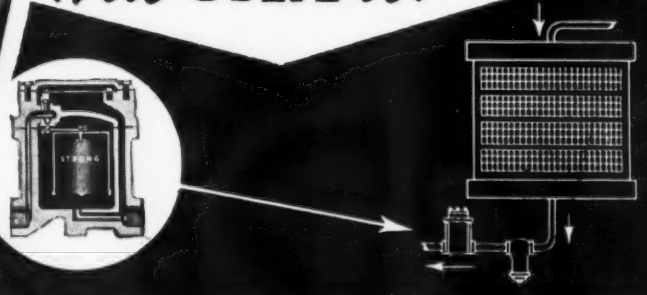
General Electric Co changes name of news bureau to technical press service. Several organization changes within N. Y. district have been announced: **G H Reid** is appointed assistant district manager. **W E Brown** has relinquished his position as manager, central station div, but will remain to handle special assignments. **H M Sliter** is made district manager and **R M Darrin** assistant district manager of central station div. **Horace Zimmer** is appointed district manager of industrial div, which is in addition to his present position of district manager, transportation div; **H M Bardin** will be manager of sales of federal

ARE UNIT HEATERS YOUR *Problem?*

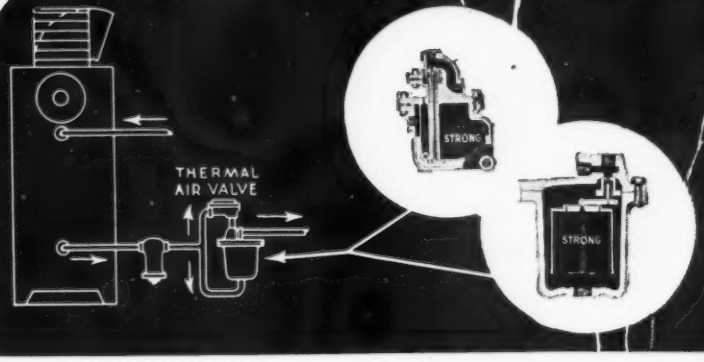
ONE OF THESE STRONG HOOK-UPS *will SOLVE it!*



Ball float and thermostatic trap—this heavy-duty trap is fitted with two valves, both of which are open during peak starting loads when large amounts of air and cold condensate are entering trap. Main valve is float controlled. Thermal unit is bi-metal, positive in operation and closing tight when line reaches steam temperature.



Inverted bucket and thermostatic trap—a two-in-one trap (blast) combining economies of inverted bucket design with thermal trap air capacity. Inverted bucket operates to discharge condensate intermittently through main valve. Separate by-pass allows free passage of air and water through thermal valve until steam temperature is reached. Valve then closes.



Open or inverted bucket with separate thermal by-pass—recommended for larger installations requiring fast heating. Separate thermal valve is piped as a by-pass around either the open or inverted bucket trap. These traps also preferred for heaters operating at pressures over 30 lbs. because of intermittent operation and minimum maintenance.

BRING YOUR DRAINAGE PROBLEMS TO US

Long, specialized experience, plus the fact that Strong makes the widest line of drainage equipment combine to give you the most satisfactory installation on any type of service.

The Strong line includes open and inverted bucket traps, float, float-and-thermostatic (blast), etc.—cast and semi-steel, forged and welded construction.

We welcome the opportunity to help you on any drainage problem. Write Strong, Carlisle & Hammond Company, Cleveland 13, Ohio.

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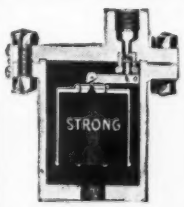
OTHER STRONG STEAM SPECIALTIES

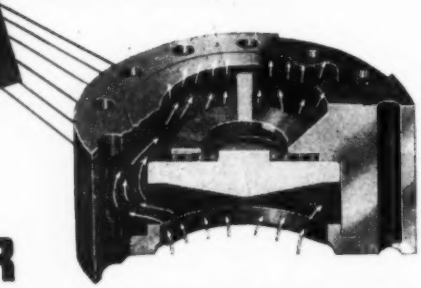


90 Series Trap

Reducing Valves

Thermal Air Valve

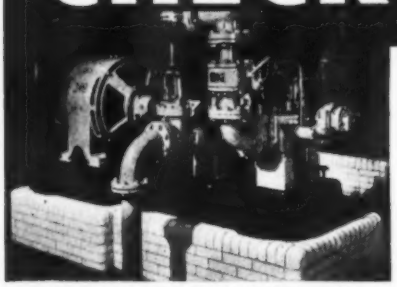
THIS NEW INFORMATIVE CATALOG WILL SOLVE YOUR "WATER HAMMER" *Problem!*



WILLIAMS-HAGER

FLANGED *Silent*

CHECK VALVES



A Williams-Hager Valve in the Metropolitan Life Building, New York.

- *Precision Engineered*
- *Economical*
- *Efficient*
- *Frictionless*
- *Tight Under Every Operating Condition or Pressure up to 6000 Lbs.*

Williams-Hager Flanged Silent Check Valves completely eliminate "Hammer" and "Bang" in the lines, provide uninterrupted constant flow of liquids.

Unlimited in size or application, from 1" to 20", built of materials to best suit the end use, Williams-Hager Flanged Silent Check Valves have been chosen for years as standard equipment in such exacting line uses as oil, gasoline, acids, water, chemicals, gas, air, salt water, brine, etc., regardless of temperature.

Write today for YOUR copy!

THE WILLIAMS GAUGE COMPANY

Pump Valves . . . Water Gauges . . . Gauge Cocks . . . Pump Governors . . . Steam Traps Feed Water Regulators . . . Water Columns

2055 Pennsylvania Ave. **Pittsburgh, 12, Pa.**

and marine section, which has been transferred from transportation to industrial div. **R B Ransom** has been made manager of New Haven office and **J J Pascher** will manage the Hartford office.

General Electric Co announces revision of its Pacific Coast set-up: **Raymond M Alvord,** commercial vice-president, Pacific district, will become a member of president's staff, remaining in San Francisco, and **Allen G Jones** will become commercial vice-president. **E O Shreve,** New York, formerly in San Francisco, heads the new staff. Others who become members of president's staff are: **T F Barton,** of New York; **W O Batchelder,** of Chicago; **L T Blaisdell,** of Cleveland; **W B Clayton,** of Dallas; **E H Ginn,** of Atlanta; **A L Jones,** of Denver; **T S Knight,** of Boston; **A S Moody,** of Portland, Ore.; and **C K West** of Philadelphia.

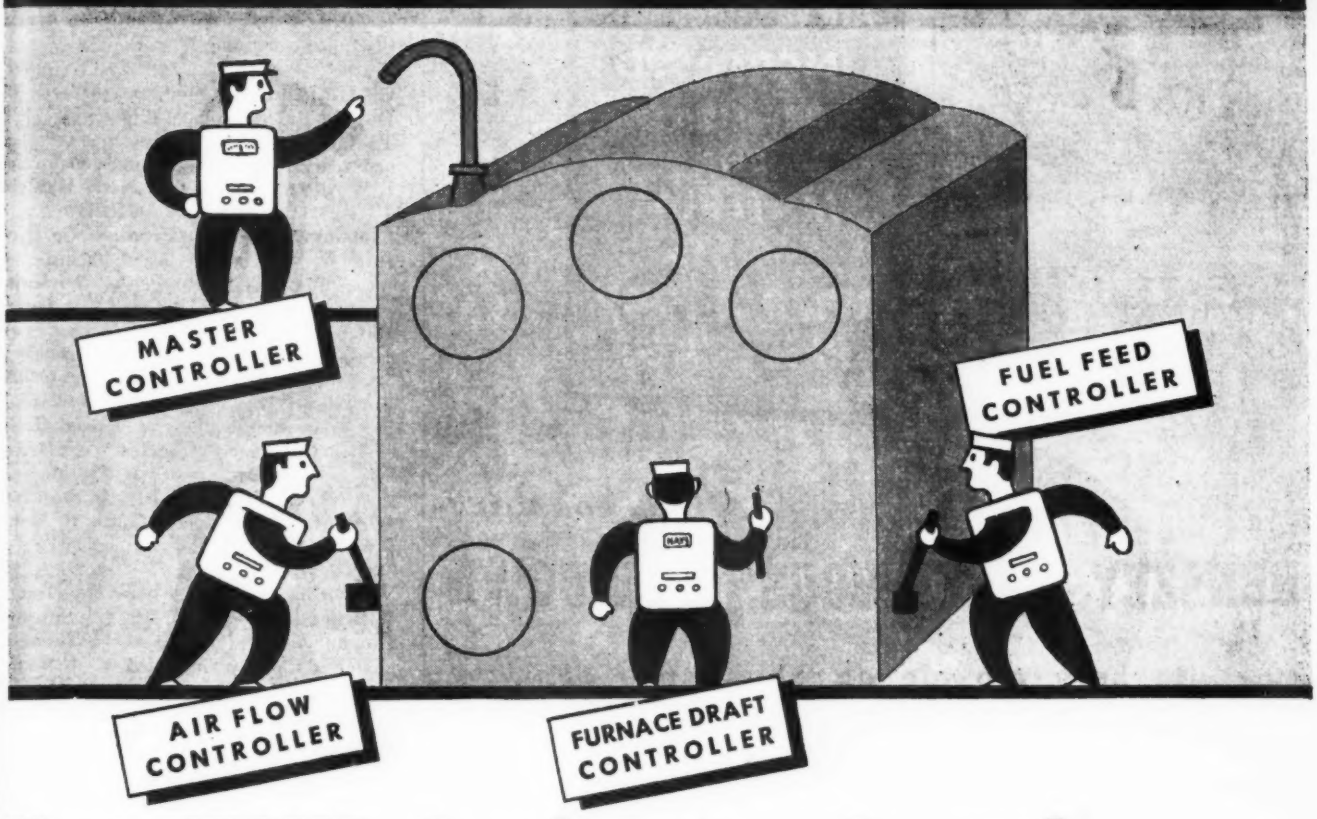
Thomas A Edison, Inc elects **Sumner F Larchar** to office of vice-president in charge of industrial relations . . . **Reliance Electric & Engrg Co** has made **R O Herbig** Central-Western sales manager . . . **T B Martin** assumes duties of director of advertising for both Detroit and Milwaukee electrical div of **Square D Co,** with headquarters in Milwaukee. **Dwight A Roehm** continues as advertising manager of Detroit div and **J Clifton Carr** as advertising manager of Kollsman div, with headquarters in Elmhurst, N. Y. **Frank Roby,** who was in the armed services, returns as sales manager of industrial controller div, with headquarters in Milwaukee . . . **Lincoln Electric Co** names **W R Persons** assistant sales manager.

U E Sandelin has been named manager of **Allis-Chalmers Mfg Co's** district office in Seattle, succeeding **A J Schmitz,** who has been named Pacific Coast regional manager with headquarters in San Francisco . . . **Carlton J Daiss** has become associated with **Charles E Moore,** president of **Joshua Hendy Iron Works** and general partner of **Moore Machinery Co** . . . **Union Chain & Mfg Co** announces appointment of **A C Mohr** as Chicago district manager.

Foote Bros Gear & Machine Corp elects **L F Campbell,** vice-president in charge of manufacturing, precision gear div; **R B Moir,** assistant vice-president in charge of sales engineering, industrial gear div; **E A Johnson,** assistant vice-president in charge of manufacturing, industrial gear div; **I C McVicar,** assistant secretary; **L J Malina,** assistant treasurer. **Gilbert H Gaus** has been appointed manager of **Gardner-Denver Co's** New York branch office at 76 Ninth Ave. **G V Leece** has been placed in charge of export div.

Tube-Turns, Inc, appoints **Arthur R C Markl** chief research engineer . . . **Metallizing Co of America** formed a new div, the **Moguloid Co of America,** with general offices at 1330 W Congress St, Chicago 7 . . . **Donald J Reese** has resumed his duties with development and research div of **International Nickel Co** at New York. **Frederick P Huston** has been placed in

ELECTRICAL OPERATION IS AS MODERN AS POST WAR INDUSTRY MUST BE!



How HAYS Combustion Control

measures, coordinates, acts . . . AUTOMATICALLY

You **See** the **12 Vital Facts** of
MODERN COMBUSTION CONTROL
in HAYS SALES VISUAL

The most comprehensive, most understandable explanation of automatic combustion control ever compiled. Ask the Hays representative to show it to you.

1. The purpose of Combustion Control.
2. How that Purpose is accomplished—3 methods of control.
3. What results can be expected of each.
4. Elements of a *good* control system.
5. Elements of a good controller.
6. *Coordinating* the controllers.
7. Selecting the best system for your needs.
8. How Automatic Combustion Control operates.
9. How each individual controller operates.
10. How controllers are calibrated and adjusted to fit requirements.
11. How controllers are stabilized to prevent hunting or over-travel.
12. Typical installations of Automatic Combustion Control.

IT'S LIKE HAVING a smart, tireless four-man crew on the job—the boss (Master Pressure Controller) who waits for the call from the plant for more steam, then calls on the others to give him the necessary cooperation; the two men who control the Air (Air Flow Controller) and Fuel (Fuel Feed Controller) respectively; and the man who keeps the furnace draft constant (Furnace Draft Controller).

To a central panel come reports of every fluctuation in every combustion factor, to be recorded and measured. Instantly accurate impulses go from the Master Controller to the Air and Fuel Controllers. These subordinate controls in turn transmit their impulses instantaneously to the damper or air control device and to the fuel feed device. Thus steam generation is ***kept in practically perfect balance constantly.***

You can see the many advantages—big savings in man-hours, important cuts in fuel bills, greatly reduced maintenance. A big help in relating those benefits to your business is the Hays Visual Presentation of Automatic Combustion Control. A Hays Engineer can show it to you—no obligation, of course. A note to us will arrange it.

The HAYS CORPORATION
SINCE 1907
COMBUSTION INSTRUMENTS AND CONTROL
MICHIGAN CITY, INDIANA, U.S.A.

Then consider

HENSZEY CONTINUOUS BLOWDOWN

to help provide an abundance of LOW COST, POWER and CLEAN STEAM!

The Henszey System keeps boiler water concentration within safe margins—insuring clean, efficient boilers and equipment by preventing foaming, priming, carry-over and the formation of sludge and scale (with proper chemical treatment).

All this positive boiler water control is accomplished continuously, and automatically—without heat loss!

Check the advantages of the Henszey Blowdown System as applicable to your present or planned boilers. Send for folder "Complete Automatic Control of Boiler Concentration".

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CONTINUOUS BLOWDOWN

Flow Indicators • Distillation Systems • Heat Exchangers
Feed Water Meters • Boiler Feed Regulators • Proportioning Valves

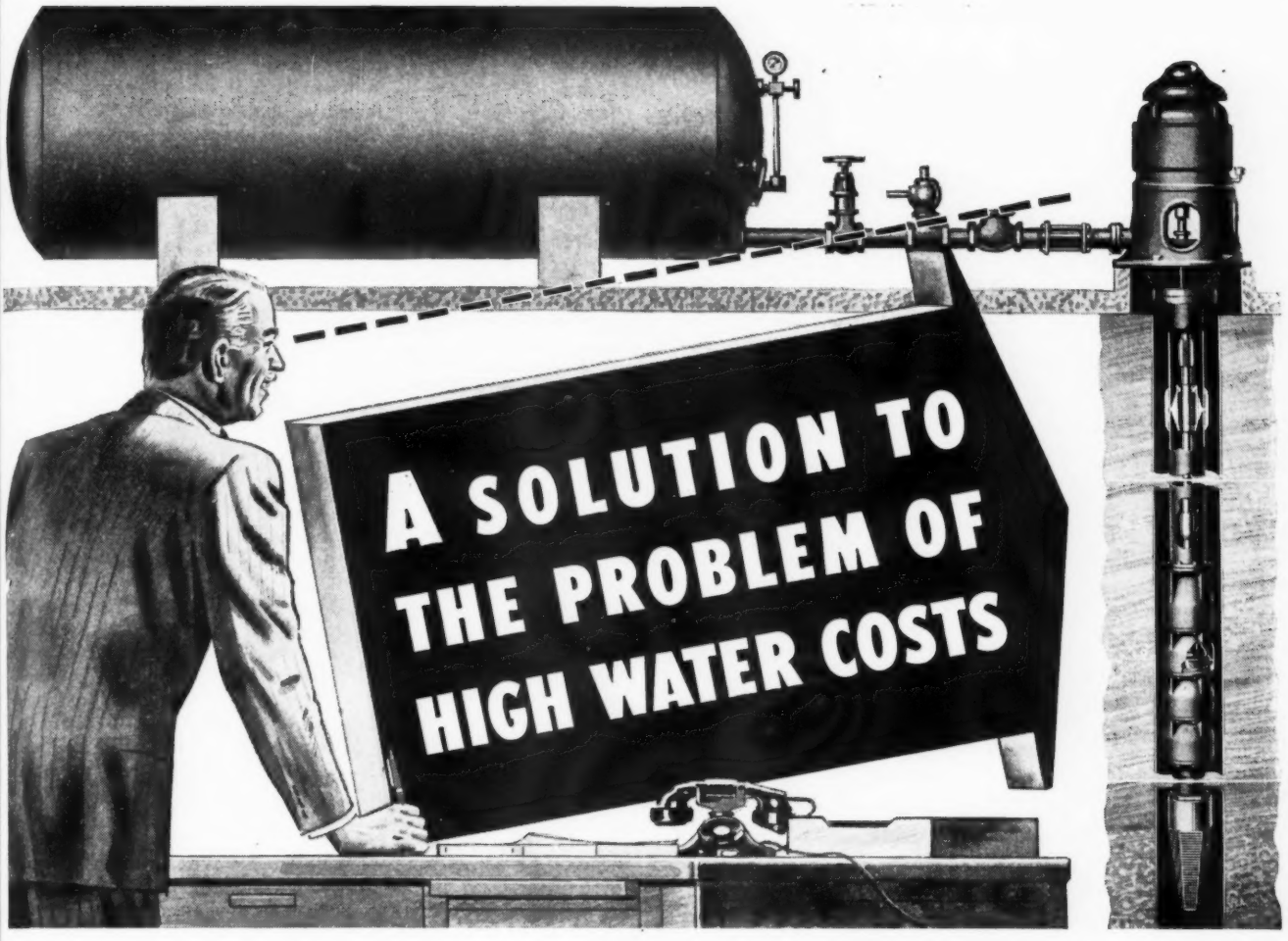
charge of Division's railroad developments in application of nickel alloy steels, cast irons, monel and other nickel alloys . . . **Crane Co** announces that **Lucien Moore** is on leave for a few months on special assignment for the War Dept.

Oakite Products, Inc, has appointed **Dr Donald Price** technical director . . . **A O Thalacker** has been made vice-president and general manager of **Detrex Corp** and **E W Allison** is now secretary. **W H Webb** is assistant sales mgr of alkali div . . . **Laclede-Christy Clay Products Co** elects **Don N Watkins** to board of directors, succeeding **A H Killinger** . . . **Wickwire Spencer Steel Co** announces that **Henry Davis** will be in charge of newly formed market research dept, with headquarters at 500 Fifth Ave, New York City . . . **Mathieson Alkali Works** has made **Howard A Sommers** chief engineer . . . **Graver Tank & Mfg Co** appoints **Charles W Springer** manager of Eastern sales at 424 Madison Ave, New York City . . . **Elastic Stop Nut Corp of America** elects **John R Munn** president.

Wilkening Mfg Co has named **Helmuth G Braendel** chief engineer . . . **Skilsaw, Inc,** appoints **E J Kelley** vice-president in charge of engineering and **J L McManus** secretary. Directors elected **E B McConville,** treasurer, to membership on board . . . **Farrel-Birmingham Co** buys **Atwood Machine Co. Franklin R Hoadley** becomes president of both companies . . . **Eagle-Picher** acquires production and distribution facilities of **Southern Lead Co,** Dallas, Texas. Operations will be conducted under newly created firm name of **Eagle-Picher Co of Texas** . . . **Otis Elevator Co** has appointed **LeRoy A Petersen** president and has elected **Edward A Fitch** to board of directors.

Monsanto Chemical Co, organic chemicals div, announced promotion of following on sales staff: **R F Caulk** to manager, flavors and condiments sales; **I J Stanley, Jr,** to manager, heavy chemicals sales; **G W Buhrman** to assistant manager, heavy chemicals sales; **A P Kroeger** to manager, intermediate chemicals sales; **R B Semple** to manager, petroleum chemicals sales; **C W Merrell** to manager, pharmaceuticals sales; **C H Sommer, Jr,** to manager, plasticizers and resins sales; **H C Koehler** to manager, special products sales; and **H F Shattuck** to assistant manager, sales dept. Pending return of Fred C Renner, **Robinson Ord** serves as acting general manager of sales of div, **A T Loeffler** as temporary assistant general manager of sales at St Louis, **A P Kroeger** as acting assistant branch manager in New York. Duties of **C H Sommer** are extended to include those of acting manager of intermediate sales. **F M Luckett** was temporarily assigned to St. Louis to assist Mr Sommer. **William M Russell** has been appointed branch manager for Detroit territory.

Caterpillar Tractor Co promotes **C A Woodley** to assistant general factory manager and **William Naumann** to factory manager . . . **Cooper-Bessemer Corp** appointed **Simson-Maxwell, Ltd,** of Van-



Install a Deming Turbine Water System

Your taxes are fixed by others. But YOU can control water costs. Here's a sample of what we mean:

A company using a large volume of "city water" for many years had taken it for granted that nothing could be done about the high water bills. Finally, an official of the company suggested an investigation to determine the facts about installing a Deming Deep Well Turbine Pump on their own property.

Result of the investigation was enlightening. The company with the assistance of a Deming Distributor determined that an annual saving of more than $3,000.00 could be made by owning their own Deming Deep Well Turbine Water Supply System.

Total costs of drilling the deep well, installing the Deming Turbine Pump and all related equipment was added to an allowance of 6% on the money invested. The annual net savings of $3,000.00 over former water costs is now an accomplished fact.

Advantages of Deming Deep Well Turbine Pumps in respect to ease of installation, adaptability to individual requirements, dependable, low cost operation and easy maintenance are contained in Bulletin No. 4700-8. Write for a copy. THE DEMING COMPANY, SALEM, OHIO.

DEMING

THE COMPLETE LINE

PUMPS AND WATER SYSTEMS

"If I ever designed a Globe Valve I'd make it easy to repack!"

Right! That's why LUDLOW STEEL GLOBE VALVES have:

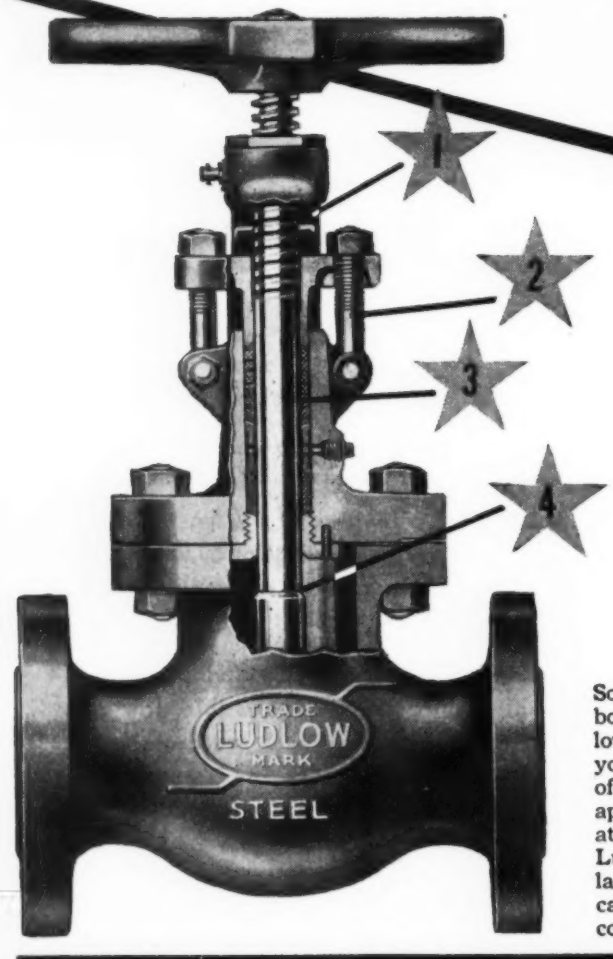
1 Two shelves on yoke to hold follower out of way while repacking.

2 Follower bolts of swing hinge-eye type, for easy repacking.

3 An exceptionally deep packing-box, to minimize maintenance and replacement.

4 A back seating arrangement to permit repacking under pressure.

G-2



So much for the packing box. Throughout the Ludlow Cast Steel Globe Valve you'll find many refinements of design that have won the approval of engineers, operators and maintenance men. Ludlow Valves are long-lasting, efficient, economical. . . . Write today for complete catalogs.

The LUDLOW VALVE SINCE 1866
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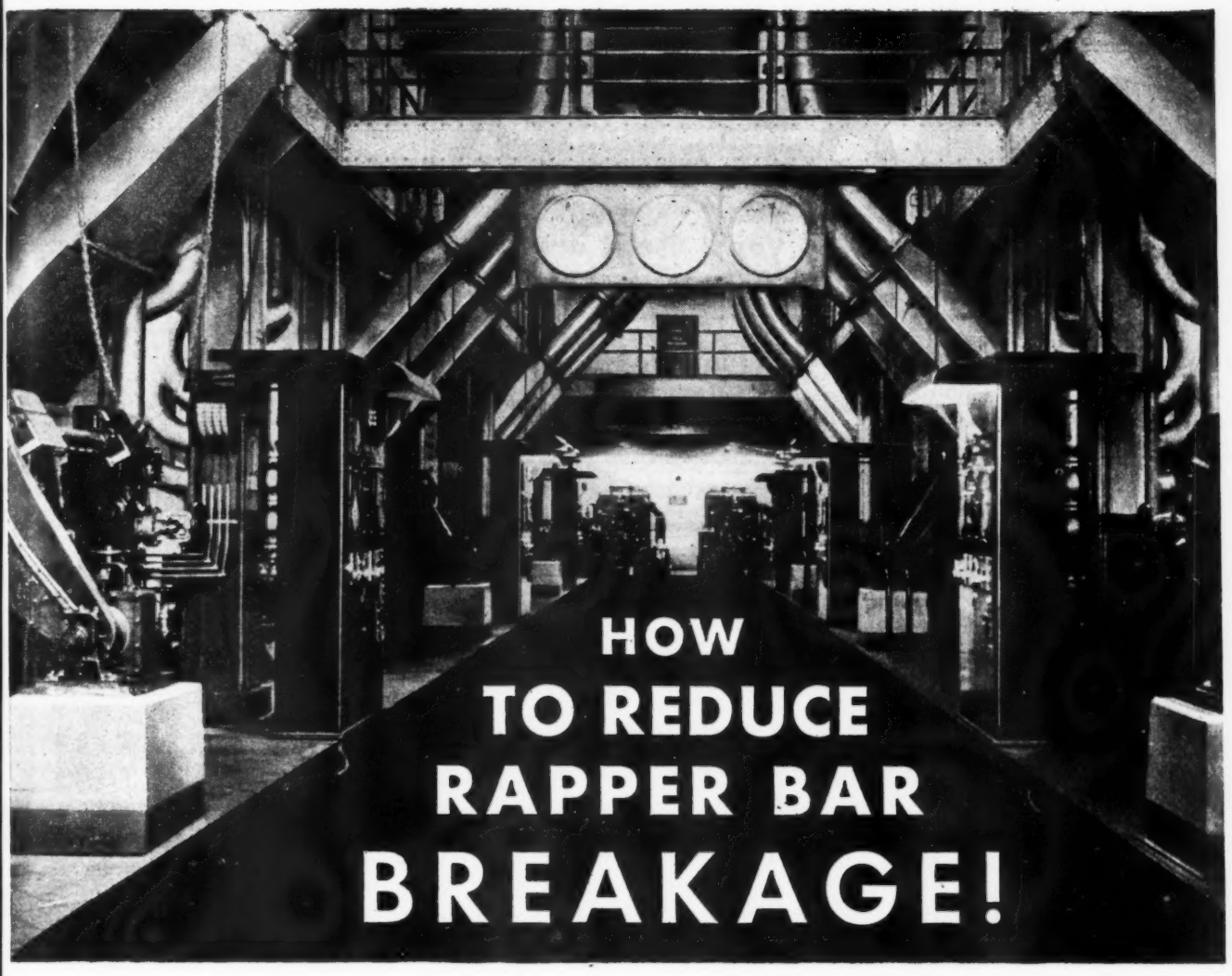
couver, as British Columbia representative . . . **Warren Steam Pump Co** names **William R Hill** general sales manager of industrial and commercial sales of centrifugal, reciprocating and paper-mill pumps . . . Located in Woolworth Bldg, New York City, new **Gardner-Denver Co** export office will be in charge of **G V Leece,** vice-president. **S T Brown,** assistant manager, and **Harold Weber,** assistant sales manager, will also be in New York export office. **Edward Church** joins Denver office in export division and **C E Kaiser** is in charge of export div in Quincy . . . **Charles C Bray** has been appointed assistant to manager of worm gear div of **De Laval Steam Turbine Co.**

C F Ogden has been named chief of conservation branch of **Office of War Utilities** power div. **Harry C Wolfe** and **Clarence Mayott** left the Office of War Utilities recently . . . **George C Doyle** has been appointed director of smoke div of **Mass. Dept of Public Utilities,** with headquarters at Boston. He succeeds **James W H Myrick,** who is retiring . . . **Herbert D Wentworth** has been appointed station superintendent of newly organized eastern div of **Public Service Co of N. H.,** with headquarters at Dover . . . **J F Bailey,** president of **Georgia Power & Light Co,** has been named vice-president and director of **Florida Power Corp.** Bailey will retain presidency of the Georgia property but will make his headquarters in the Florida power offices in St. Petersburg . . . **John L Collins,** plant engineer in charge of distribution engineering and property record department of **Central Maine Power Co,** has been elected president of **Maine Association of Engineers.**

Charles F Mosher, for many years general superintendent of **Western Massachusetts Elec Co,** Turners Falls, and a prominent figure in hydroelectric plant operating circles in the Northeast, has retired after 37 years of service. Mr Mosher was elected a member of board of directors as he left office. He has been succeeded by **Arthur L Davis.**

Industrial Unit Heater Association elected following officers: F P Kohlbry, president; N Downey, vice-president; and L O Monroe, secretary-treasurer . . . **American Institute of Electrical Engineers** named following for offices becoming vacant August 1, 1945: *President*: W E Wickenden *Vice-Presidents*: Ernest S Fields, Herman B Wolf, L M Robertson, F F Evenson, F L Lawton *Directors*: John M Flanigen, J R North, W C Smith *National Treasurer*: W I Slichter. **National Association of Fan Manufacturers** elects R H Nelson president, C T Morse vice-president and L O Monroe secretary-treasurer . . . **Resistance Welder Manufacturers' Association** named Charles Eisler president and David Sciaky and H V Beronius co-vice-presidents for 1945.

Valve Manufacturers Association elects following officers: *President:* W B Holton, Jr; *Vice-Presidents:* Lucien W Moore, J. P Ferguson, C W Burrage; *Secretary-Treasurer:* George A Cooper; *Directors:* C C Chamberlain, Oliver F Gang, C W Watson,



This is the Government's central heating plant in Washington.

It's an installation that consumes from 100 to 600 tons of coal per day . . . and it's also an installation where rapper bars seldom break.

Why? Because after encountering excessive failures in the Cottrell precipitating units, the operators made replacements with bars of chromium Nickel "18-8" *stainless steel.*

Differing from the unalloyed steel bars . . . which fractured near the ends and thus indicated weakness from corrosion at the stuffing box junctions . . . stainless steel suffers no steady loss of metal and strength as do corrodable materials.

Considerably stronger than ordinary structural steel and immune to virtually all oxidizing-acid conditions, stainless steel also provides an impact value that the toughest of the common alloy steels cannot meet.

In addition, stainless steel renders exceptional resistance to scale and creep at elevated tempertures.

Utilize the wide experience gained in the field of alloys by the technical staff of The International Nickel Company. Counsel and printed data about the selection, fabrication and heat treatment of ferrous and non-ferrous metals await your request.

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THE PACKING THAT "PACKS ALL"

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Here's the universal packing that can be used for any fluid or on any apparatus. One size packs all — economically, efficiently — tightly — simply.

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The short, small diameter motors necessary for passage through short radius bends impose harsh restrictions on the power such motors will develop. This lack of power often slows up tube cleaning. It may even cause serious time charges through excessive down-time of equipment cleaned.

Wilson cleaners for curved tubes will help you overcome these and other troubles. There is a Wilson Tube Cleaner for every curved tube from 1" O.D. up and for almost every radius. Let a Wilson Tube Cleaner cut your down-time and solve your curved tube cleaning problems.

Thomas C. Wilson, Inc. maintains a large engineering staff for consultation on difficult or unusual tube cleaning problems. Write today for a copy of the new Wilson Tube Cleaner Check List and a 40-page bulletin describing the complete line of Wilson Tube Cleaners. No obligation.

Modern tube-cleaners for the problems of today.

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Hugh Foster, W F Crawford, Ernest Cochran . . . **Chesapeake and Ohio Railway Co** appoints **George G Ritchie** general fuel service engineer . . . **Hill and Knowlton** moved its Cleveland office from 1454 Guildhall Bldg to 323 Republic Bldg.

Henry J Kaiser engineers have organized as a permanent group, known as **Kaiser Engineers,** with headquarters in Kaiser Bldg, Oakland, Calif. Company plans to undertake engineering work in any part of the world. **Henry J Kaiser** is president, **E E Trefethen, Jr,** and **T M Price,** vice-presidents, and **George Havas,** vice-president and general manager. **George W Vreeland** serves as chief consulting engineer and **George B Scheer** as chief consulting electrical engineer.

A L Thalheimer, who became superintendent of claim dept of **Hartford Steam Boiler Inspection & Insurance Co** in 1936, has retired from active service. He graduated from Sheffield Scientific School, Yale University, in 1889 and operated an engineering office of his own at Hartford, Connecticut, before joining the insurance company in 1898 as a member of the inspection staff.

CURRENT AWARDS

Brad Foote Gear Works has received Army-Navy "E" flag. **Sterling Engine Co** has been awarded a third star for its "E" flag. **Brown Instrument Co, U. S. Machine Corp** and **Henry L Crowley & Co** have received the same honor.

Ohio Injector Co and **Edwards & Co** have each received four stars. **Chase Brass & Copper Co** has been awarded five stars. Philadelphia plants **of Philco Corp** and Simplex radio div in Sandusky, Ohio, have received the 17th and 18th Army-Navy "E" awards made to the company. Manhattan rubber mfg div of **Raybestos-Manhattan, Inc,** has been granted AAF quality control rating.

OBITUARIES

John Robert Hagemann, 44, manager of engrg in steam turbine dept of Allis-Chalmers Mfg Co, died Feb 15.

Hubert Marion Artz, 70, operator of Triplett Power Plant, Woodstock, Va., died recently.

Charles F Norton, 60, former sales manager for Louis Allis Co, died Feb 11 at his family home near Alhambra, N. Y.

Harry C Alber, 52, prominent air-conditioning engineer, died Feb 8 in Los Angeles, Calif., following a heart attack.

William Stoddard, former stationary engineer, died in Providence, R. I., recently where he has resided for 50 years. He was past president of British Club of R. I.

Harvey Morse Cushing, 69, for 22 years chief mechanical engineer for Buffalo Niagara Electric Corp, died Jan 31.

Alfred C Marshall, 73, director, consultant and chairman of operating council of Detroit Edison Co, died Feb. 9.

Clean

• Just the single advantage of being clean makes Cleaver-Brooks Steam Generators the first choice of many experienced steam plant buyers.

The modern design and construction of Cleaver-Brooks oil-fired steam generators assure clean, smokeless, efficient operation, and a "show-place" boiler room.

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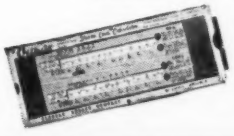
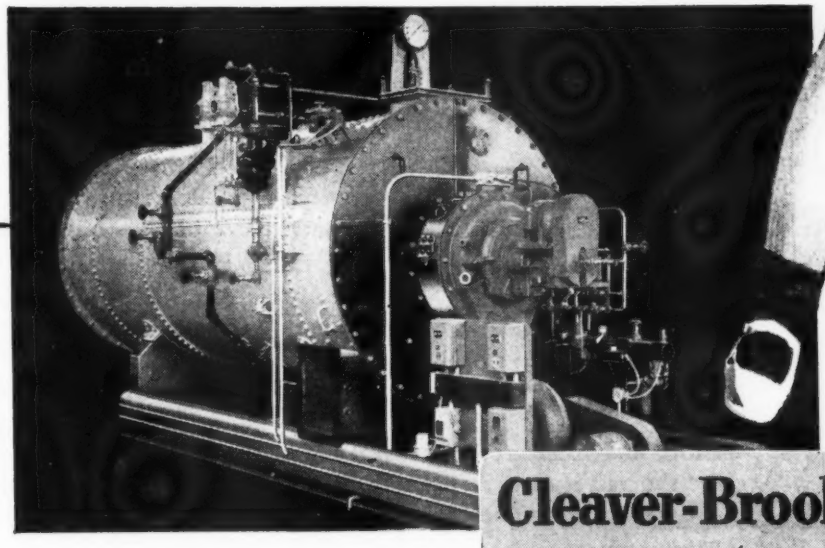
5109 N. 33rd Street • Milwaukee 9, Wisconsin



WRITE ON YOUR BUSINESS LETTERHEAD
for the Free Steam Cost Calculator—a ready-reference slide rule showing the comparative steam costs when using oil or coal as fuel.



Why Not Have a Steam Plant with All These Advantages?

Cleaver-Brooks
STEAM GENERATORS

• A steam-plant tailored for your job. Cleaver-Brooks analyzes your load conditions, space and equipment arrangements, future growth needs, puts unit into initial operation, instructs as to operation, care, maintenance.

• Designed for utmost convenience of operator — all controls may be operated from front of boiler. A factory engineer puts unit into initial operation, and trains your employees in operation, care and maintenance.

• One source and one responsibility for the complete generator — Cleaver-Brooks Factory-finished and tested — a fully "packaged" unit meeting all code requirements.

• Fast installation. No special foundation needed. Within 24 hours after arrival, your Cleaver-Brooks Steam Generator can be in operation.

• No smoke-stack required; simple roof-high vent exhausts combustion gases.

• Saves space, uses less plant area, fits into low head-room locations.

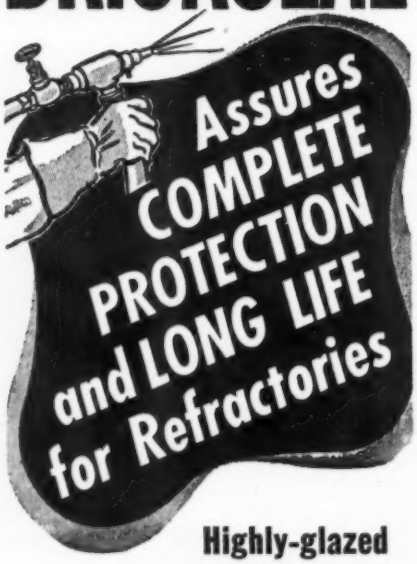
• Oil-firing eliminates smoke, ashes, clinkers, messy boiler-room conditions.

• Low operating costs; unsurpassed guarantee: — 80% thermal efficiency; 13% CO_2 gases; stack temperature not to exceed 125° F above saturated steam temperatures.

• Quick steaming — for any emergency or fluctuating loads — through high heat transfer with Cleaver-Brooks 4-pass down-draft construction and integral oil-burner.

• Full size range is available — 22 models in sizes from 15 to 500 hp., at steam pressures from 15 to 200 lbs. p. s. i. Write for bulletin and complete information.

BRICKSEAL



Highly-glazed monolithic coating prevents cracking and spalling

Brickseal will reduce to a minimum the danger of untimely failure of boiler refractories. This widely-used refractory coating, applied like paint with brush or spray gun, forms a highly-glazed, heat-reflecting, monolithic, protective surface which prevents damage due to cracking, spalling, slagging, air infiltration and sudden temperature variations.

Brickseal should not be confused with ordinary air-set washes which form a plaster-like surface coating. Brickseal consists of high-fusion clays and metals combined in oils. Furnace heat burns the oils and vitrifies the clays and metals, which penetrate deeply into all pores, cracks and joints, binding the bricks into a durable, monolithic wall.

Brickseal cannot crack, blister or peel off due to sudden temperature changes because, at operating temperatures, it becomes semi-plastic, permitting it to expand and contract with the wall. Brickseal also binds old cracked or loosened bricks. Clinkers may be removed without damage to lining.

You can secure Brickseal protection with very little cost or delay. Write for sample today.

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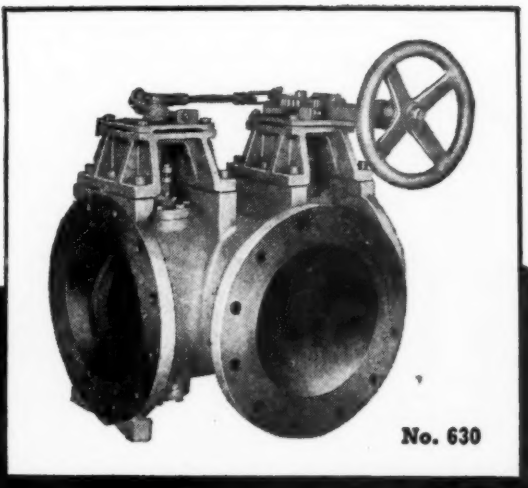
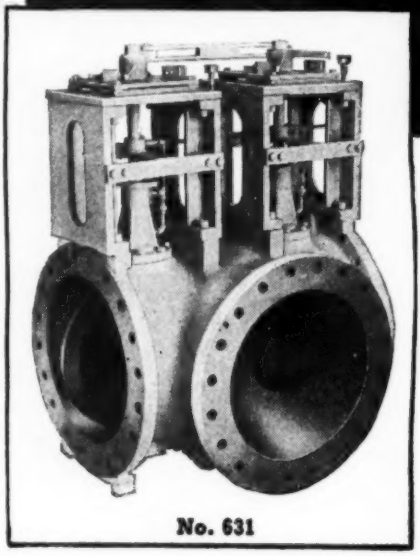
REFRACTORY CO.
1029 CLINTON ST., HOBOKEN, N. J.

R-S
QUALITY PRODUCTS SINCE 1908

15 to 900 psi
Control and shut-off of volume and pressure for air, gas, steam, liquids and semi-solids



TORQUE IS EQUALIZED in *Quick Operating* Three-Way Valves



All R-S Butterfly Valves are precision engineered, metallurgically and mechanically, and this is the chief reason why the Three-Way Valves have met widespread approval and acceptance.

Designed for mixing and quick interchange service, these valves are adapted to pressures from 15 to 900 psi and for elevated or sub-zero temperatures. In manual operation, four to six revolutions of the hand wheel fully open or close the valve vane. Adjustable linkage is usually provided so that the mixture can be changed at will.

With a pressure drop across the valve, the vane tends to close itself. The torque on the closed right-hand vane (see illustrations) is opposite to that on the open left-hand vane so that the torque is equalized and no excessive load is placed on the prime mover whether the operation is manual or automatic.

Available in sizes from four to sixty inches. Write for details and Catalog No. 14-B.

VALVE DIVISION
R-S PRODUCTS CORPORATION
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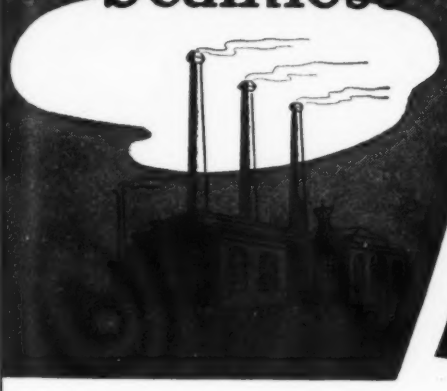
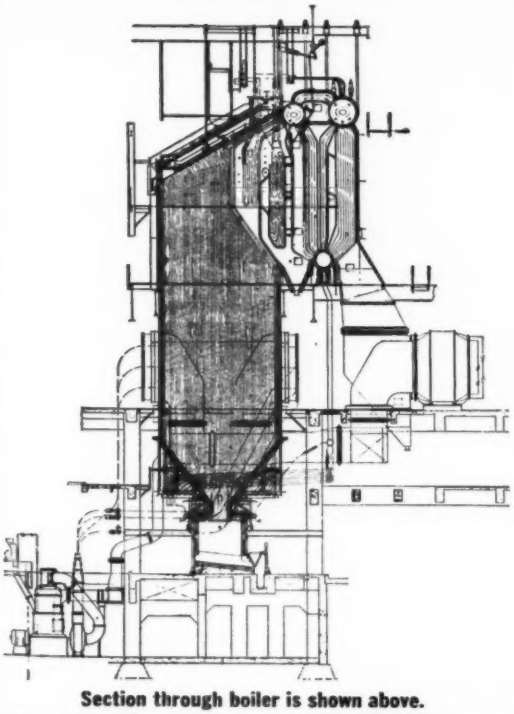
R-S *Streamlined* **BUTTERFLY VALVES**

New Power Station *tubed with* Pittsburgh Seamless



Partial view of boiler showing roof and water wall tubes.



Section through boiler is shown above.

Year after year, for forty-two years, *Pittsburgh Seamless* has been used to tube the boiler installations of some of the most modern power plants of the period. Once again, in a large new power station in Virginia, *Pittsburgh Seamless* was selected for its known reliability.

Since its inception Pittsburgh Steel Company has pioneered in seamless tubing manufacture and has been identified with many of the advances of the industry. The same technicians and production specialists who were able to develop the successful tubular Railway Axle, have brought comparable skill to the perfection of Pittsburgh Boiler Tubes, Heat Exchangers, Condenser Tubes and High Pressure Piping.

For trouble-free performance, always specify *Pittsburgh.*

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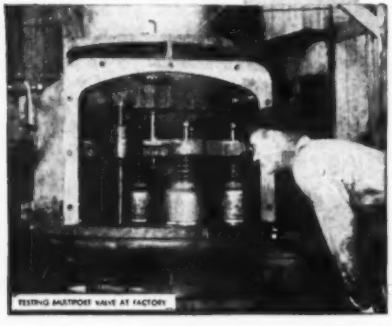
Why they Last and last and Last

The Cochrane Multiport Relief Valve is popular not only because of its remarkable service, but because of its long, trouble free life.

COCHRANE MULTIPORT RELIEF VALVES

In many plants all over this country Cochrane Multiport Back Pressure Relief Valves have been operating continuously for ten, twenty, twenty-five years—and longer—with out replacement of a single part. The care, the skill, the close precision to which this remarkable valve is built, are some of the reasons.

Write for Publication 4150



TESTING MULTIPORT VALVE AT FACTORY

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A *Fuel Saving method* THAT IS SIMPLE AND DEPENDABLE

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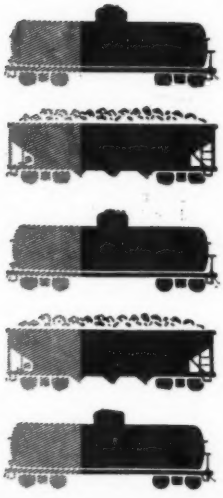
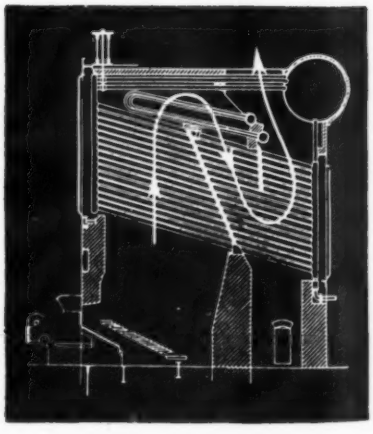


They are easily put to work because they are adaptable to any type of water-tube boiler—and the entire job can be turned over to this company.

Dependable because they are designed on sound engineering principles, backed by The Engineer Company's quarter-century of experience in this field. Baffles are individually designed to meet the requirements of each boiler. Installations are made by our mechanics whose skill in this work is unsurpassed.



A Booklet Worth Having

Details of these baffles, with descriptions of novel and ingenious constructions used in numerous types of boilers are available in this booklet. It is looked upon by many engineers as a reference book of real value. Your copy will be sent on request.

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YOU'LL WANT THE PRODUCTION ADVANTAGES OF EQUIPMENT LIKE THIS—

BUT—IS YOUR ELECTRICAL WIRING PLANNED TO CARRY THE LOAD?

New, efficient equipment of every kind promises tremendous postwar production advantages. Don't let lack of electrical capacity bar you from such opportunities.

Make sure your wiring plans are based on *future* needs, not *past* experience. Remember, rush teardowns for alterations will be costly. Wire ahead!

Now is the time—while you're in the planning stage—to call in your consulting or plant power engineer,. electrical contractor or power salesman. They'll agree *foresighted* wiring will cost a lot less than the "wait and see" kind.

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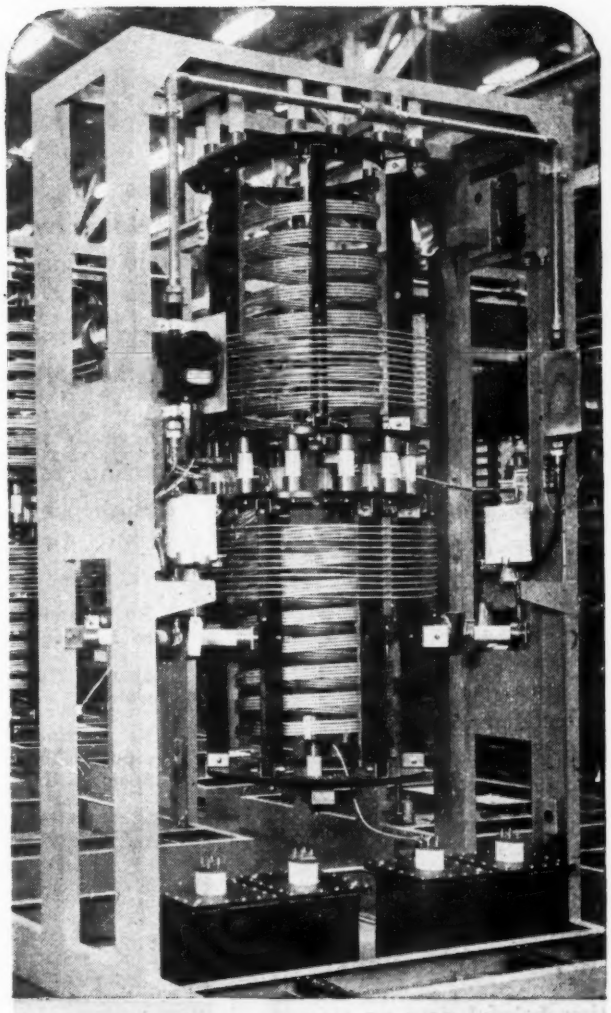

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In this working component of a high-powered induction-heating unit, brief applications of relatively large amounts of power heat metals from within. Heat distribution is quick, uniform.

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It is far safer to use than commercial raw acid—a fact which users confirm when a recommended solution is circulated, flushed out and then neutralized. This specialized Oakite method helps you put this maintenance task on an easier, speedier and more economical basis.

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WHEN YOU USE THE WESTPORT WELDED JOINT

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When you engage Mitchell & Co. you are assured of getting fabricated piping with the latest in Power piping design, which includes the Westport Welded Joint.

Features of this joint include:

1 **No constriction in pipe area due to Backing Rings**
2 **Smooth Pipe contour at base of weld**
3 **No sacrifice in strength of the pipe due to removal of wall or Backing Ring**
4 **No gaps between rings and the inside of the pipe wall**
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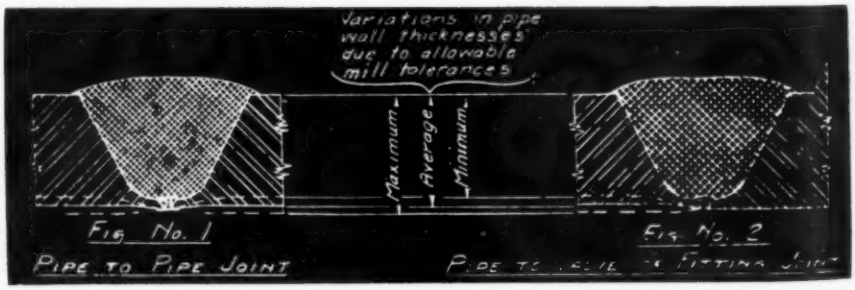
6 **Meets A.S.M.E. Standards.**



The Westport Method . . . illustrated above . . . consists of the use of a joint in which the ends to be welded are formed and machined to provide a special U-shaped groove . . . joining the lips at the roof of the weld by the oxyacetylene process . . . and completing the joint by the usual electric arc procedure.

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with correct steam traps and temperature control

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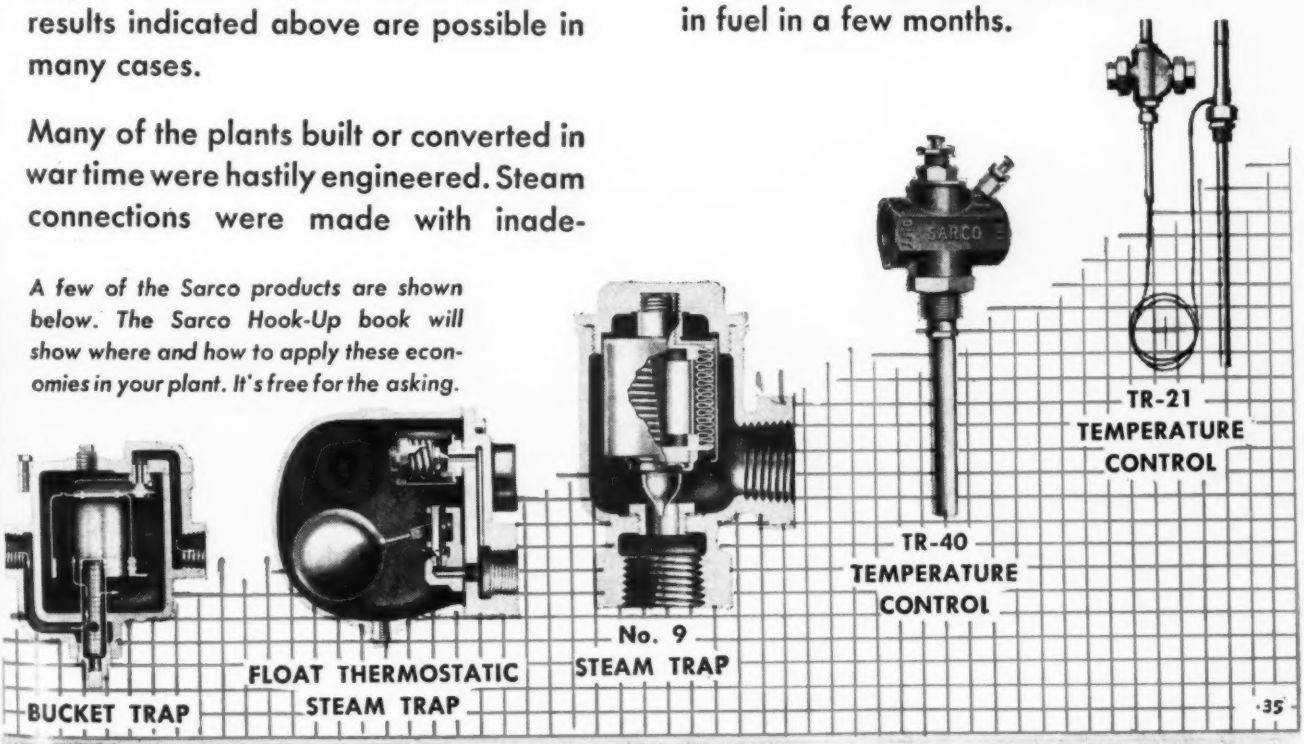

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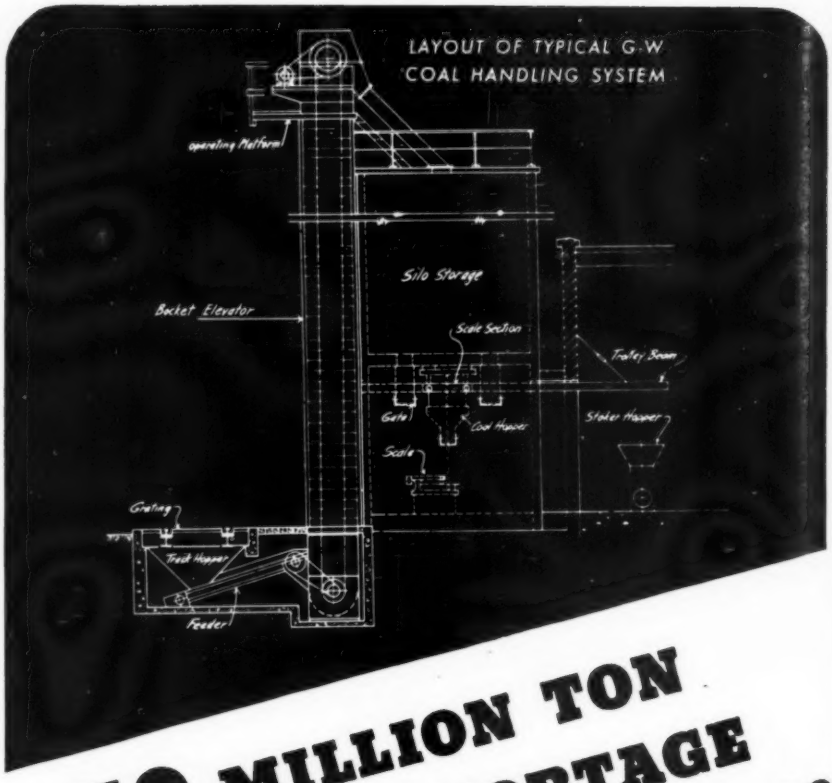

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Yes . . . according to estimates of the Solid Fuels Administration for War . . . "total production will be from *40 to 55 million tons below requirements*".

That means that Industry must economize on coal. Are you alerted? Power men today must be on the alert more than ever to assure full efficiency in their steam-generating units . . . check every possibility for furthering economy in coal consumption—right on down to the receiving of their coal, its storage, and its delivery to stokers or pulverizers.

As designers and builders of coal storage and coal and ash handling systems for over 130 years, Gifford-Wood stands ready to cooperate with you to the fullest. Standard and special designs—or combinations—to meet individual requirements will gladly be adapted by G-W engineers in consultation with your Engineering Dept. Catalog P-200 will also be a big help with its 120 pages of pictures, drawings, tables and Engineering data. Write for your copy today.

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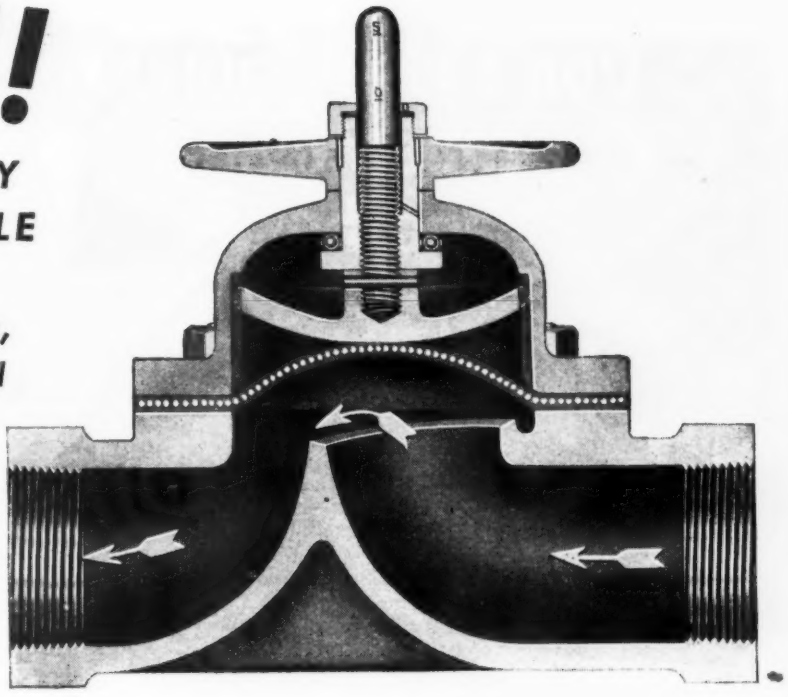
...PRACTICALLY INDESTRUCTIBLE

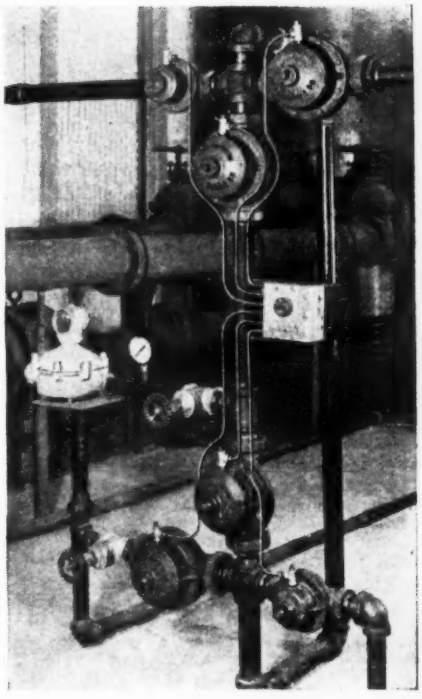
in Service with upwards of 100 Acids, Alkalies, Abrasives and Suspended Solids



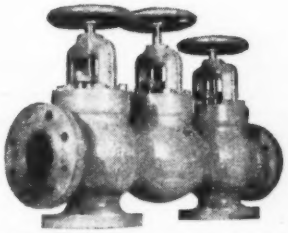
Available in 10 sizes, ½" to 6", Screwed or Flanged. In semi-steel or lined with rubber, glass or lead. Pressures to 150 lbs. Temperatures to 150° F. These valves are being extensively used to replace more expensive valves in chemical plants, industrial plants, mines, sewage disposal plants, water works, paint factories, paper mills, food processing and other industries. Hand-operated type at right; below, pilot-operated type controlling flow rate, backwash and rinse cycles in Mid-West industrial plant.

McALEAR

No. 1455 Corrosion and Abrasive Proof DIAPHRAGM VALVE



BECAUSE diaphragm completely separates fluids from working parts, mechanism of this valve is trouble-free—cannot freeze in outdoor service—and *no stuffing box or repacking* is required. Valve does *not* depend on metal-to-metal contact for closure. Hence *no leakage is possible* and *no reseating ever necessary*. Shape of weir prevents accumulation of solids—offers minimum resistance to flow—and *positive shut-off* is provided by diaphragm *even* when solids are trapped on the seat. Valve is installable *in any position* without danger of leaks. Suitable for on-or-off or for throttling service. Special types may be operated from remote points by air or water pressure, controlled by automatic timeclock or pilot. Write for McAlear Diaphragm Valve Bulletin.



H-W TYPE 1800 COMPACT BY-PASS MANIFOLD
Simplifies piping designs, eliminates a number of flanged or screwed connections, saves space, reduces leakage hazards without increasing installation costs. Sizes ⅛ to 4 inches. Bronze, cast iron, steel, union and bolted bonnets, screwed and flanged ends. Also silver braze and steel socket weld. Write for H-W Bulletin 117.

IF YOU HAVE A CONTROL PROBLEM, call on McAlear engineers. Draw on their fund of experience . . . on their readiness and willingness to help you develop special controls when *unusual* conditions require them. For informative bulletins or catalog, write McAlear Manufacturing Company, 1913 S. Western Avenue, Chicago 8. *Affiliated with Hanlon-Waters, Tulsa, Okla.; Climax Engineering Co., Clinton, Iowa.*

H-W McALEAR
PRESSURE · FLOW · LIQUID LEVEL · TEMPERATURE
controls
for STEAM, WATER, AIR, OIL or GAS

Don't risk damage to tube cleaners and hose

Kinking tube cleaner hose to shut off air is poor practice at any time, especially now, when hose is a critical material. Besides ruining the hose, small hose particals may peel off and clog the motor

Why risk damage to tube cleaners and hose by kinking the hose to control the air. A Roto Operating Air Valve attached to the tube cleaner motor, enables the operator to control the air safely, entirely by himself. This inexpensive valve speeds up tube cleaning and releases a helper for other work. Our complete line of modern, efficient tube cleaners will meet practically every requirement. Write.

ROTO

Division of Elliott Company

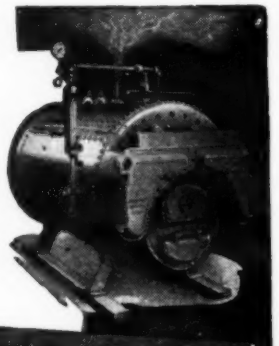
145 Sussex Avenue **Newark 4, N. J.**

KEWANEE

SCOTTIE JR BOILER

5 sizes for small industrial usage. 9.9 to 30 H.P. Conveniently compact, yet easily accessible. Low in cost—economical to operate.

75 Years Boilermakers



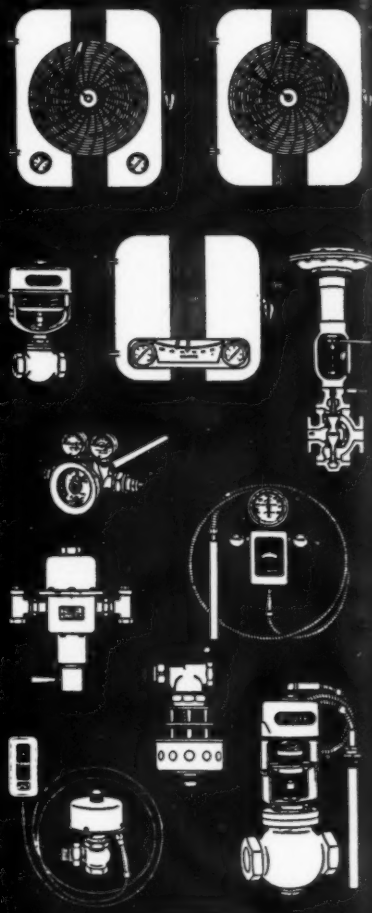
For 6" scale with pipe diameter marking, write Department 99-K-4

KEWANEE BOILER CORPORATION Kewanee, Illinois

Division of AMERICAN RADIATOR & STANDARD SANITARY CORPORATION

POWERS

TEMPERATURE and HUMIDITY CONTROL



When you want accurate and dependable automatic temperature or humidity control for Industrial Processes, Heating or Air Conditioning Systems, call in a Powers engineer. With over 50 years of experience and a very complete line of self-operating and air operated controls we are well equipped to fill your requirements.

Write for Circular 2520

2721 Greenview Ave., Chicago
Offices in 47 Cities—See your phone directory.

THE POWERS REGULATOR CO.

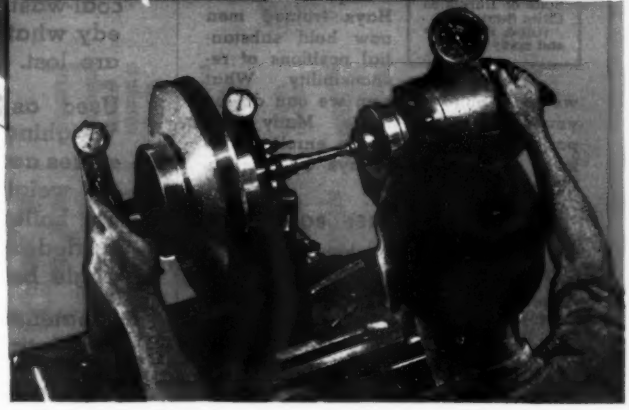
Pacific

FOR HIGH EFFICIENCY PUMPING OPERATIONS

IN Pacific's 20 years of precision pump building experience, there has never been a pumping problem encountered that Pacific Pumps couldn't lick . . .and with top efficiency, too!

Every type and size of pump in Pacific's entire line is scientifically correct in design and construction. No matter what your requirements may be . . . a single pump or complete plant facilities . . . Pacific can furnish the right equipment to do the job efficiently and economically.

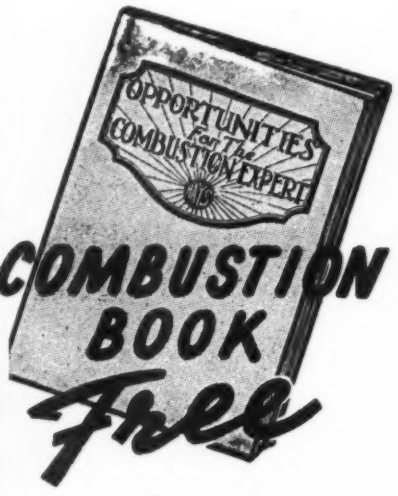
The above illustrated Pacific Type JB Centrifugal Pump is designed for boiler feed and hot water circulating systems. Available in 2 to 8 stages, sizes 1½" to 6", speeds to 3600 R.P.M., capacities to 1600 G.P.M., differential pressures to 1000 lbs., operating temperatures to 500° F. Catalog No. 80 gives full engineering data. Write for your copy!



Pacific's rigid specifications demand Impeller perfection. On this specially designed machine, sensitive to split-hair measurement and register, each Pacific Impeller is tested for dynamic balance. Result . . . smooth, vibration-free performance . . . long, efficient pump life.

PACIFIC PUMPS, INC., Huntington Park, Calif.
One of the Dresser Industries
Export Office: 30 Rockefeller Plaza, New York

PACIFIC *Engineered* PUMPS



Combustion efficiency as applied to Boiler Plant Operation. Fuels and Equipment is now a most important factor in Defense work. Fuels cost more than ever before. Boiler loads are heavier. A scarcity of some kinds of fuel is apparent.

The Combustion trained man—the Hays trained man — can do his part, and open up big opportunities for himself that never existed before, by devoting a little of his spare time in training himself to meet present conditions.

Just a Few of Our Hundreds of Friends

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and many others.

How? Through the simple, easy reading, *practical* Hays Home Study Course in Fuel and Combustion Engineering. For 26 years the Hays Institute has specialized exclusively in training in Combustion Efficiency. Hundreds of Hays trained men now hold substantial positions of responsibility. What we have done for them we can do for you, in your spare time. Many companies urge their men to enroll. They know the value of Hays Combustion Training.

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Please send me your Free Book "Opportunities for the Combustion Expert"—No Obligation.

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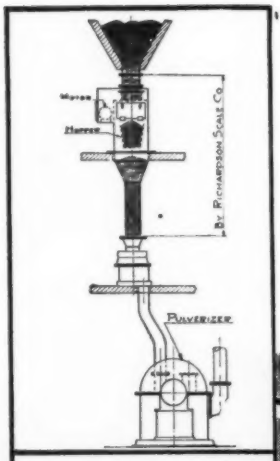
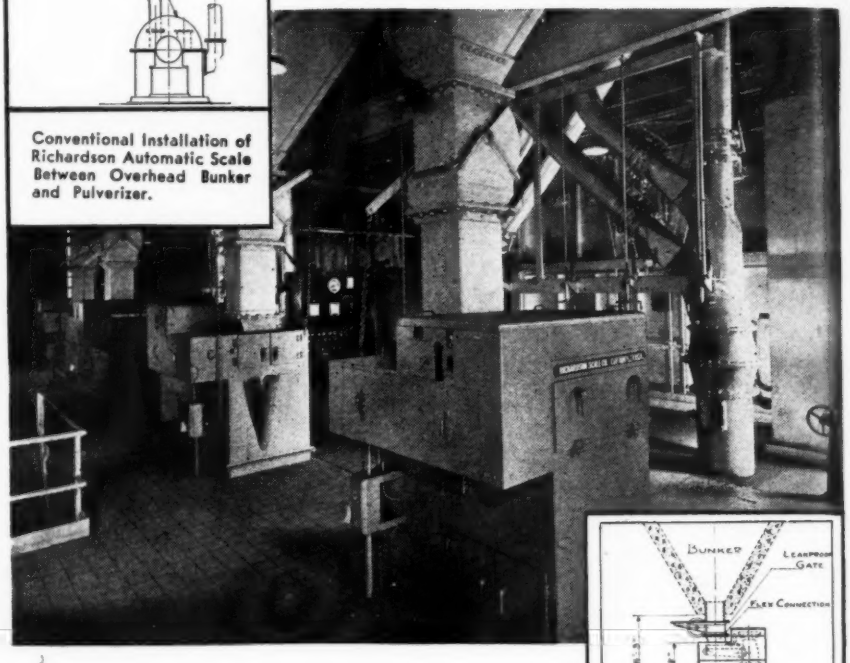


Conventional Installation of Richardson Automatic Scale Between Overhead Bunker and Pulverizer.

WEIGH COAL TO EACH BOILER and REDUCE FUEL COSTS

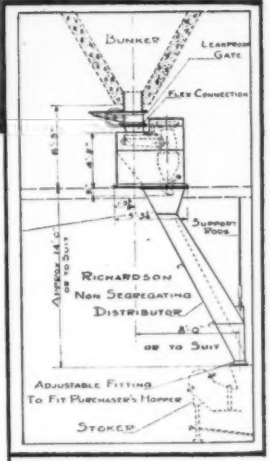
With Richardson Coal Scales



With the aid of Richardson Automatic Coal Scales you can quickly pick out the coal-wasting boilers in a battery . . . remedy what's wrong *before* fuel and money are lost.

Used as units of a Richardson Coal Weighing and Feeding System, these scales accurately and indisputably record the weight of coal consumed by individual boilers; indicate uniformity of load carried by multiple pulverizers serving a single boiler.

A patented Richardson feature for stoker installations is the "Monorate" Non-Segregating Distributor. A reduced section down its center improves on flat spouts, permits uniform velocity throughout. Since lumps do not turn, the cause of segregating coarse and fine lumps is removed.



Conventional Method of Installing Richardson Automatic Scale for Weighing Coal to Stoker.

BULLETIN NO. 1143

is packed with helpful facts, technical details, diagrams and photographs of installations of Richardson Coal Scales. Write for your copy.

RICHARDSON SCALE CO.

CLIFTON, N. J.

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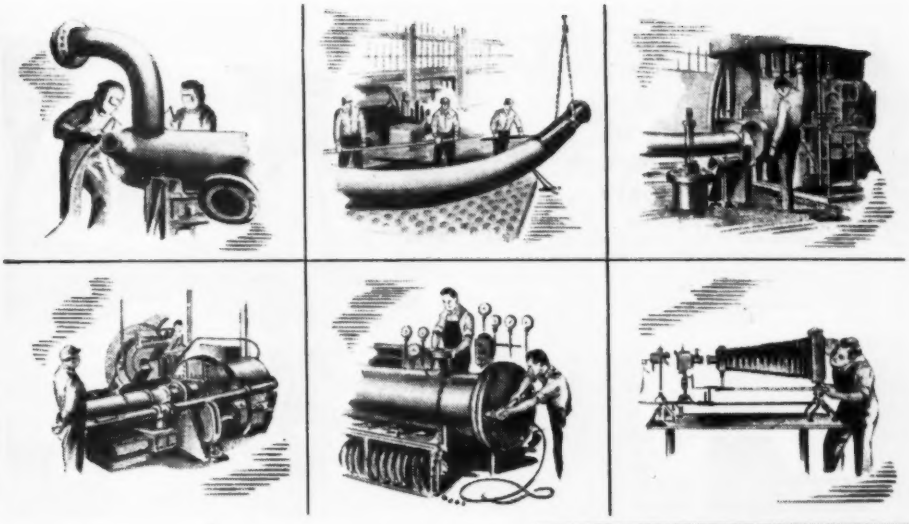
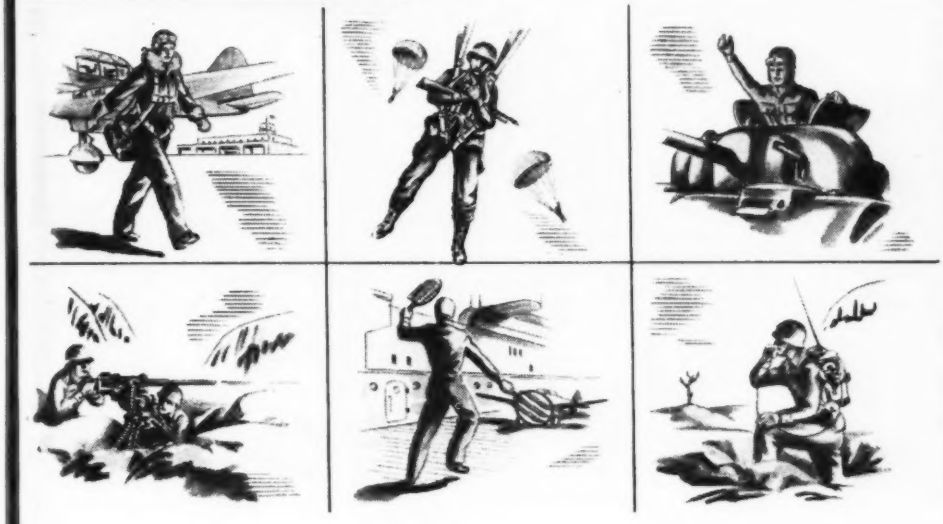
Minneapolis • Detroit • San Francisco • Toronto • Wichita • Pittsburgh

On the PIPING FRONT





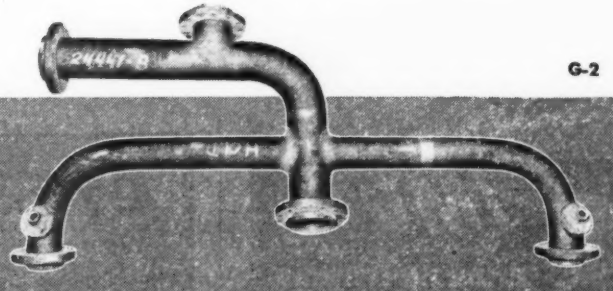
as on the FIGHTING FRONT

The armed forces include a long list of specialists: aviators, paratroopers, tank drivers, artillerymen, walkie-talkie operators, etc.—all received highly specialized training so that they can do their vital jobs correctly.

The piping front also depends upon specialists. Welders, benders, machinists, lapping machine operators, metallurgists, research engineers, radiograph technicians, furnace operators, etc. have had specialized training in the plants of qualified pipe fabricators.

These piping specialists, plus the specialized equipment (such as rotating fixtures, and jigs for welding, straightening tables, etc.) available in fabricating plants, enabled qualified fabricators to do an outstanding job in meeting the tremendous demand for piping in the great industrial conversion to war production.

This is a War of SPECIALISTS



G-2

THE PIPE FABRICATION INSTITUTE

P.F.I. THE PIPE FABRICATION INSTITUTE

Devoted to the Technical and Economic Problems in Piping

1108 CLARK BUILDING, PITTSBURGH, PA.

ADAMANT
FIRE BRICK CEMENT

Try this method of keeping down furnace maintenance costs . . .

Lay-up linings with Adamant . . . its higher bonding strength (see below) protects the structure at the joints where failure usually begins. Result . . . linings last longer . . . production is maintained . . . repair costs and replacement materials saved.

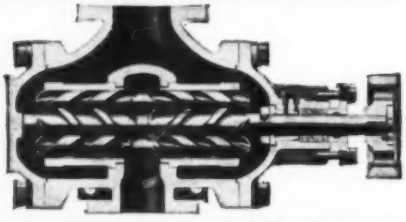
ADAMANT
Stronger by Test

Impartial laboratory tests showed Adamant has a bonding strength of 800 lbs. at room temperature; 1270 lbs. at 2600° F. Adamant has a P.C.E. of 3000° F. plus. For more details, write

BOTFIELD
REFRACTORIES COMPANY

784 S. Swanson St., Philadelphia 47, Pa.
In Canada, Canadian Botfield Refractories Co., Ltd., 171 Eastern Avenue, Toronto

IMO

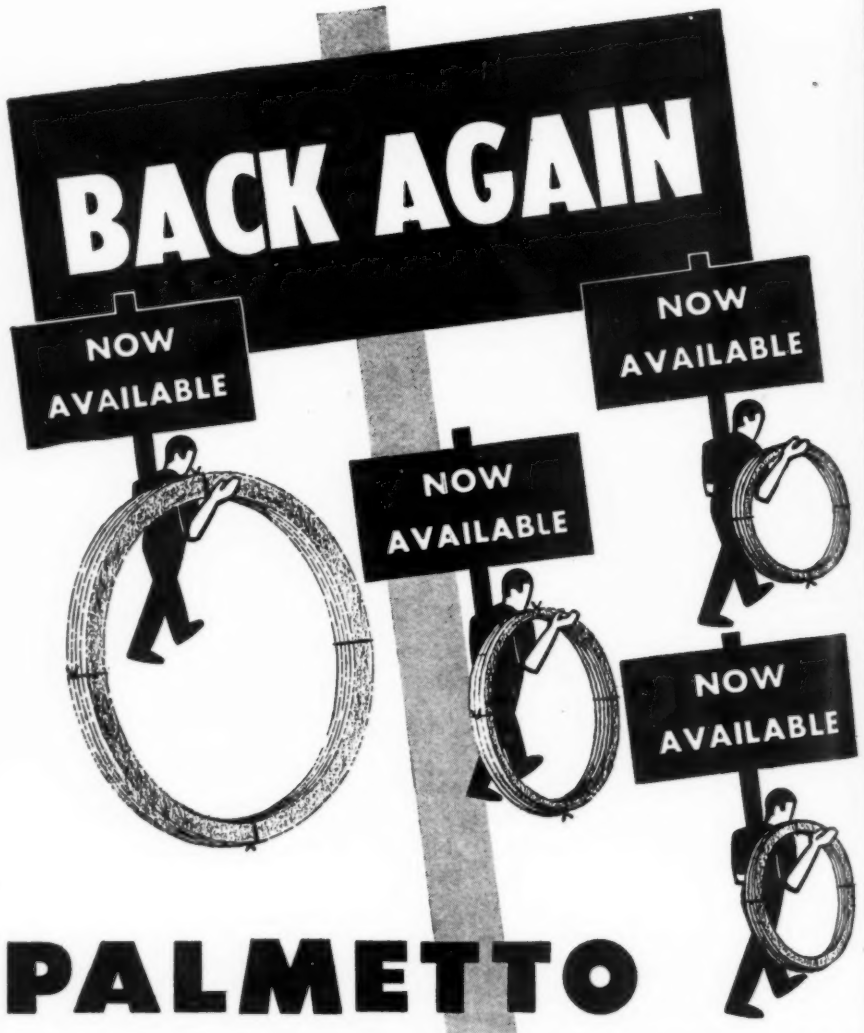


THE PUMP *without* PULSATION

The steady, uniform flow produced by the continuous turning of the rotors in an IMO pump is ideal for oil burners, hydraulic and other service requiring an even, pulsation-free flow.

IMO
PUMP DIVISION OF THE
DE LAVAL STEAM TURBINE CO.
TRENTON 2, NEW JERSEY

BACK AGAIN



PALMETTO
HIGH-PRESSURE FOLDED ASBESTOS
GASKETS

PALMETTO
Asbestos
Metallic
Sheet
Packing
is also now available

for Handholes and Manholes of Boilers and for Other Steam Services. Your inquiries and orders will receive prompt attention. Order TODAY.

GREENE, TWEED & CO.
Manufacturers of the Famous PALMETTO Packings for Every Service
Bronx Blvd. at 238th St., New York 66, N.Y. Plants at New York, N.Y. and North Wales, Pa.

A Simplified SK Strainer . . .

designed to give you more for your money

Here is a duplex strainer which does a thorough job of removing dirt and other foreign matter from oil, water and other liquids, *yet is moderately priced.*

Check These Features:

DUPLEX DESIGN—
Permits cleaning without flow interruption.

ONLY 1 VALVE—
Single shut off cock provides continuous flow during switchover and is pressure balanced for easy operation. Steel spring takes up any plug wear and insures against leakage.

VERTICAL BASKETS—
Allow continuous flow while cleaning. Dirt is collected in basket which is easily removed without loss of fluid. Strainer free area is a minimum of 5 times pipe area.

SINGLE-SETSCREW CLAMPS—
Quickly removable, yet seal basket chambers tightly.

PACKING GLANDS—
Nut-and-stud type, easy to adjust and will not corrode and "freeze."

PLUG DRAINS—
On basket chambers, provide convenient arrangement for draining fluid from unit.

Made of cast bronze, these SK Duplex Strainers are designed for pressures up to 125 psi, in pipe sizes from ½ to 2 inches. Being light-weight, they need no support other than the pipe line.

Other SK Strainers are made in cast iron up to 250 psi or steel for pressures up to 600 psi and sizes up to 6 inches.

SK FLOW INDICATORS

. . . save time, trouble and expense

Positive flow information in critical sections of pipe lines is provided by SK Flow Indicators. Power may be conserved, a continuous process may be kept in operation and damage to expensive equipment may be prevented.

Cast bodies, available in red brass or meehanite iron, are designed to withstand the same pressures as extra heavy pipe fittings. Glass is tempered plate, thermal-shock resistant, and being at least ½ inch thick is practically unbreakable. Indicating vane is rotary type of light plastic, corrosion resistant and almost frictionless.

For use in any position at pressures up to 250 psi and temperatures up to 250° F., these Flow Indicators are supplied in pipe sizes from ½ to 2 inches, inclusive.

Flapper type Flow Indicators having glass on one or two sides are available in pipe sizes from ½ to 3 inches, inclusive.

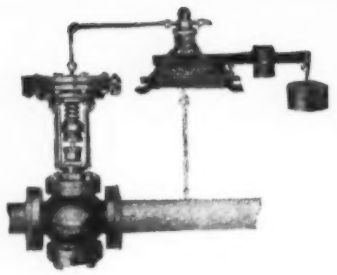
SCHUTTE & KOERTING COMPANY
Manufacturing Engineers
1150 Thompson Street, Philadelphia 22, Pa.

JET APPARATUS • CONDENSERS AND VACUUM PUMPS • HEAT TRANSFER EQUIPMENT • VALVES • ROTAMETERS
FLOW INDICATORS • GEAR PUMPS • STRAINERS • OIL BURNING EQUIPMENT • SPRAY NOZZLES AND ATOMIZERS • RADIAFIN TUBES

ATLAS

Super-Sensitive

PRESSURE REGULATORS



These remarkable regulators are particularly adapted to service where pressures must be maintained within fractions of one pound and without perceptible variation even where demands fluctuate and widely varying initial pressures occur. They are suitable for steam, air, gas, etc. where it is essential to maintain a constant reduced pressure in heating mains, vats, cookers, retorts, etc. They may also be applied as altitude regulators to maintain constant level in open tanks, or as a pump governor to assure constant pump discharge pressure.

The scope of applications of these ATLAS Regulators is almost unlimited in pressure regulation. They will accurately regulate at any pressure between the initial pressure and atmosphere in one stage, operating control valves from ½" to 6".

Write for "Bulletin No. 1B" Giving Complete Details

No. 801—for reduced pressures 2 to 15 lb.
No. 801-S—for reduced pressures 0 to 5 lb.
No. 802—for reduced pressures 15 to 150 lb.
Sizes ½", ¾", 1", 1¼", 1½", 2", 2½", 3", 4", 5", 6".

Check the items in the coupon below on which you want information.

ATLAS VALVE COMPANY
REGULATING VALVES FOR EVERY SERVICE

289 South St., Newark 5, N. J.

Representatives in Principal Cities

☐ Without obligation, please send "Bulletin No. 1 B." Also, please send complete information on the following ATLAS products:

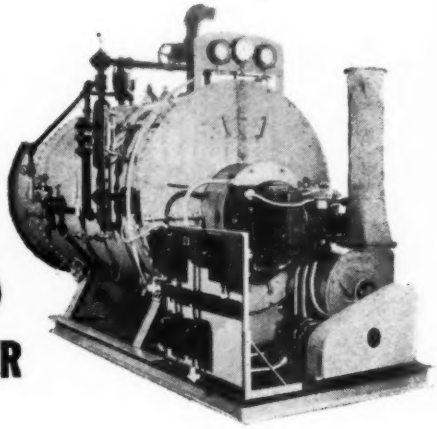
☐ Damper Regulators
☐ Temperature Regulators
☐ Exhaust Control Systems
☐ Pressure Regulators
☐ Campbell Boiler Feed Water Regulators
☐ Pump Governors
☐ Float Valves
☐ Oil Control Cocks
☐ Humidity Controllers
☐ Thermostats
☐ Balanced Valves
☐ Control Valves

Name .....
Firm .....
Address .....

Says the Power Plant Engineer: **"YOUR JOB CAN BE BETTER TOO"**

"Here's what happened when I mailed a coupon like the one below:

1. ***The management has a much better understanding of me and my job . . .***
2. ***I have an appropriation for a new, completely modern steam plant with an overall efficiency stepped up to 80% or higher — a***



PREFERRED
UNIT STEAM GENERATOR

Compact, self-contained, completely coordinated, consisting of boiler, oil burner, induced draft fan, controls, piping, wiring—everything ready to hook up and start the burner. Requires no stack, no special foundation, minimum floor space. 20 to 500 HP sizes.

THIS CAN HAPPEN TO YOU

Send the coupon and you'll get two valuable things FREE . . . A 36-page booklet packed with vital information on steam production—facts and ideas for you to pass on to the management for the betterment of your job . . . And a folder giving full information on Preferred Unit Steam Generators. Sending this coupon may prove the biggest thing you've ever done for your future—how about sending it NOW?

SIGN AND MAIL NOW — — — — — — — — — — — — — — — — —

Preferred Utilities Mfg. Corp.
1860 Broadway, New York 23, N. Y.

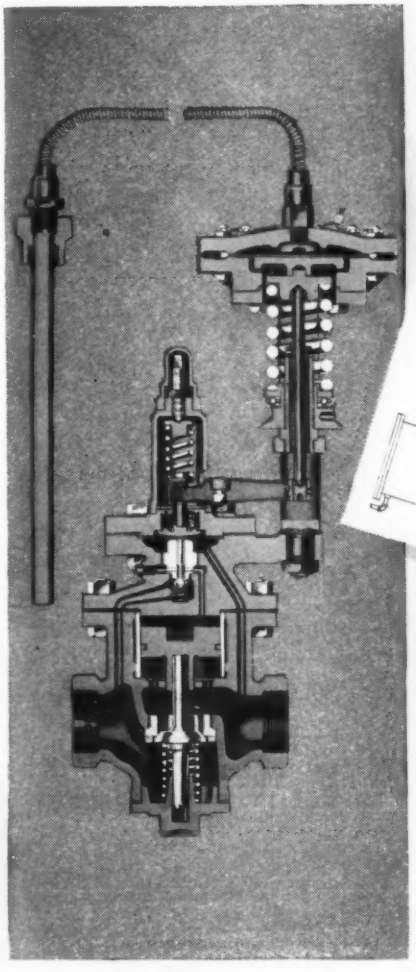
Please send me DIVIDENDS FROM YOUR POWER PLANT and full details on PREFERRED UNIT STEAM GENERATOR.

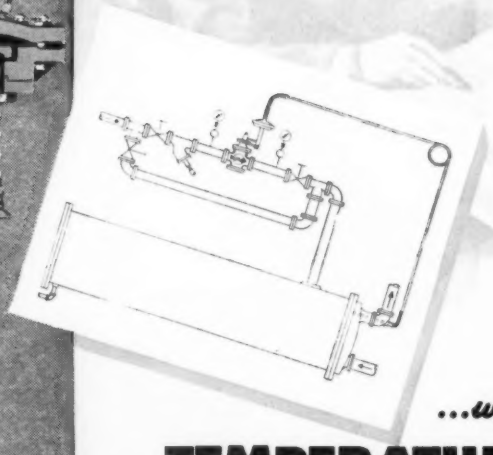
NAME .....
ADDRESS .....
P 4-45 .....

PREFERRED UTILITIES — Trusted for Results — ENGINEERED

PREFERRED UTILITIES

"We can simplify our piping...cut installation costs—and CONTROL BOTH Temperature and Pressure"...





...with the TRADE MARK LESLIE REG. U. S. PAT. OFF.

TEMPERATURE REGULATOR

SELF-CONTAINED

Anywhere in your plant – wherever you want to guard your least or your most important processes with BOTH accurate temperature regulation and pressure control, simultaneously – you can easily and quickly install the Leslie Temperature Regulator with the assurance of absolute dependability of results.

• *EXTREME ACCURACY AND SENSITIVITY*

This Regulator was designed for accurate, dependable control where other regulators failed. In brief, it holds temperatures *constant,* in the closest limits, with the *minimum* expenditure of steam.

• *MAY WE HELP YOU?* Leslie Engineers are prepared to work with you to help you select the correct type of Leslie product for your needs and to advise you regarding the most effective methods of installation. When writing please give *complete details* as requested in our bulletins.

features...

DUO-MATIC CONTROL – Temperature Regulation and Pressure Reduction with a SINGLE regulator

WIDE RANGE, RUGGED THERMOSTATIC ELEMENT—100°F adjustable temperature

SINGLE SEATED for positive dead-end control

METAL DIAPHRAGMS—No bellows or packing glands

RENEWABLE WEARING PARTS – 100% interchangeability

CORROSION & WEAR RESISTANT—Stainless Steel Hardened Wearing Parts.

FOR COMPLETE DETAILS WRITE FOR BULLETIN 404A

LESLIE CO. • LYNDHURST • NEW JERSEY

NEVER TOO HOT.. NEVER TOO COLD

VITAL TO CONVALESCENCE and final recovery is complete temperature control. Important enough in the case of health, it becomes virtually obligatory in the presence of illness, where sudden changes of temperature might have serious consequences.

Fulton Sylphon Temperature Controls and Regulators provide a wide opportunity for the design and construction of heating and ventilating systems in which rooms can be held constantly at *optimum temperatures* with maximum dual economy. Correct *modulating* action is provided...not sharp (dangerous) corrections from "too hot" or "too cold."

Write for Bulletin GS-821. Many types of Sylphon Regulators are available. All are simple, rugged, self-contained, basically self-powered.

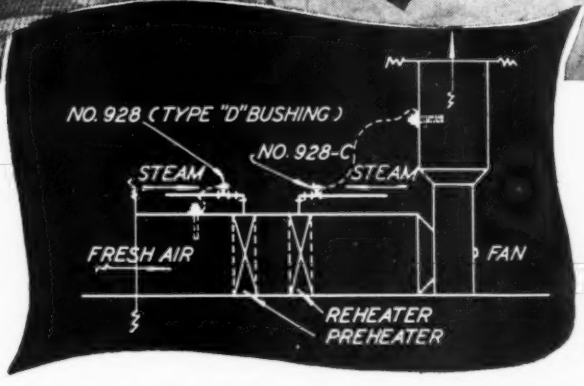


Diagram of typical Central Fan System Control. Fulton Sylphon Regulator No. 928 on pre-heater gives freezing protection. No. 928-C governs steam supply to re-heater, thus maintaining even desired temperature of delivered air.

NEW MOVIE . . . "The Story of a Bellows" is available to interested executives and organizations. It demonstrates graphically how a bellows converts pressure and temperature changes into controlled mechanical movement. It also shows clearly the operations of various types of temperature regulators.

FULTON SYLPHON

TEMPERATURE CONTROLS ... BELLOWS ASSEMBLIES

THE FULTON SYLPHON CO., KNOXVILLE, TENNESSEE

The Drake is equipped with SLOAN FLUSH VALVES

The Drake

LAKE SHORE DRIVE · CHICAGO · SUPERIOR 2200

December 6, 1944

OFFICE OF THE
CHIEF ENGINEER

Sloan Valve Company,
4300 West Lake Street,
Chicago, Illinois.

Gentlemen:

When the Drake Hotel was built about 25 years ago, Sloan Royal Valves were installed at that time. They have given us most excellent service.

To keep these valves in top working condition, we have found that the cost of re-washering has been very small. The simplicity of the construction has made them very easy and inexpensive to service, and in addition, they are consistently economical in the use of water. They require no constant regulating.

To sum up, Sloan Royal Flush Valves have turned out to be a very good investment for us, and they still are. I fully believe that they will still be going strong for another 25 years.

Very truly yours,
Erich B. Utescher
ERICH B. UTESCHER
Chief Superv. Engineer
Drake-Blackstone Hotels

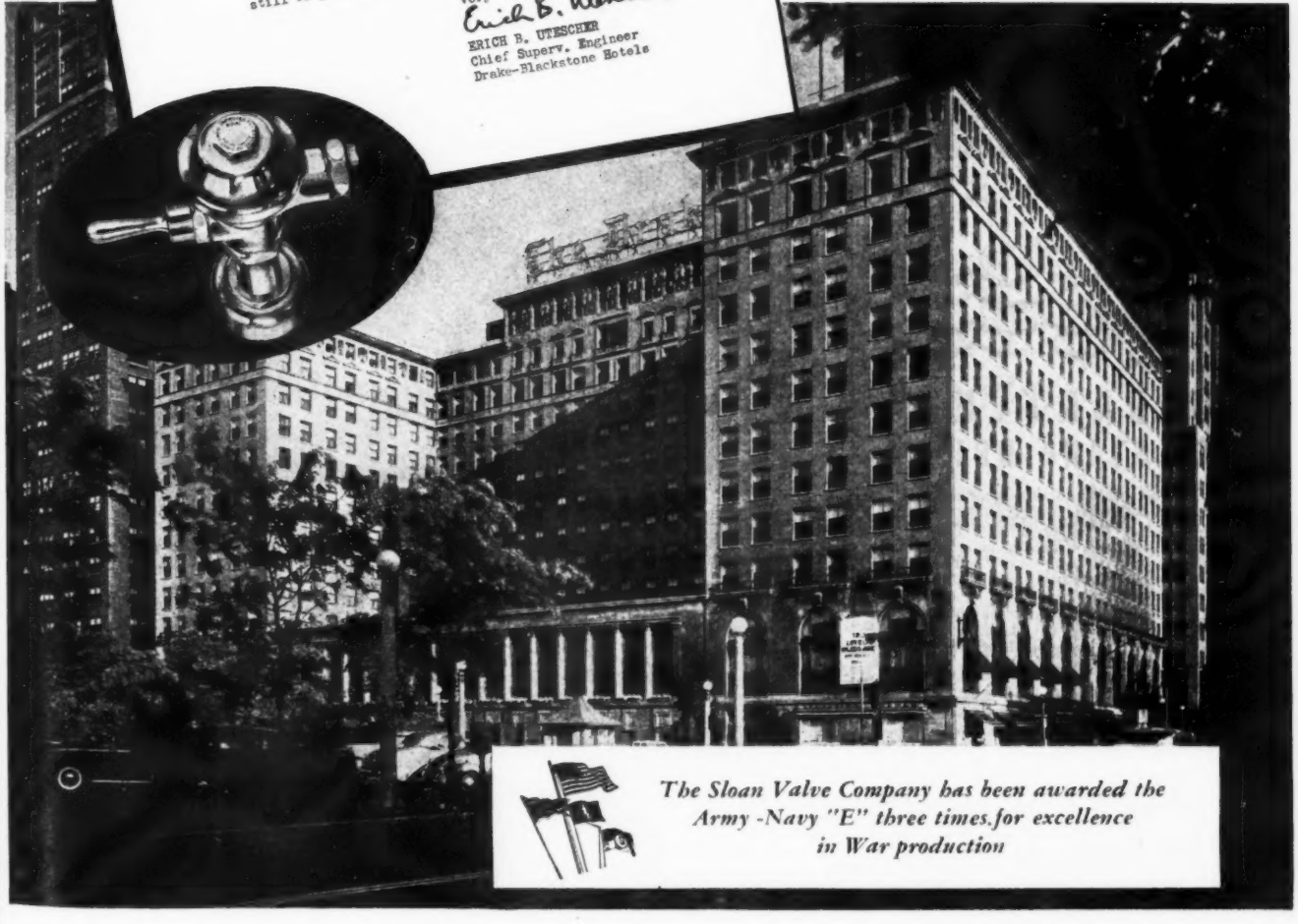
THE DRAKE, at the north gate of Chicago's famous Michigan Avenue, is one of the nation's finest hotels—and like the majority of the nation's finest hotels, is equipped with Sloan Flush Valves.

Says Mr. Utescher, Chief Engineer, "Sloan ROYAL Flush Valves were installed when the Drake was built about 25 years ago and have given most excellent service—I fully believe they will still be going strong for another 25 years."

With unequalled dependability of operation and with maintenance costs as low as ¼ of 1c per valve per year, your choice of Sloan will assure you of the best in Flush Valves.

Remember—there are more Sloan Flush Valves sold than all other makes combined.

SLOAN VALVE COMPANY
4300 W. Lake St., Chicago



The Sloan Valve Company has been awarded the Army-Navy "E" three times for excellence in War production

ALL-OUT
ATTACK *against dust*
***with* TORNADO**

KEEP dust "all out" with TORNADO—powerful, one-man portable Industrial Vacuum Cleaner. Its use insures quicker cleanups at less cost—floors, ceilings, walls, boiler tops. Gets rid of dust and dirt. Salvages scrap, flux, etc. Especially designed for industrial, heavy-duty type of cleaning. 1 h.p. G.E. universal motor. 49" waterlift, 175 c.f.m. Weight 40 lbs. 12-gal. tank. Outside bag. Costs less than 3¢ an hour to operate.

Request details and FREE TRIAL Offer

BREUER ELECTRIC MFG. CO.
5114 Ravenswood Ave., Chicago 40

TAKE THE DUST OUT OF DUSTY INDUSTRY
TORNADO
PORTABLE INDUSTRIAL VACUUM CLEANER

HERCULES
Seamless Copper
FLOATS

HERCULES

GUARANTEED
TO STAND UP!

Every Hercules Float carries our guarantee to stand up under 350 lbs. working pressure and 500 degrees temperature.

Fabricated of seamless copper under our special spinning process. Hercules Floats are uniform in thickness and high in mechanical strength.

You can depend on Hercules for floats—in standard shapes up to 10 in. and in special types to your specifications—to give long, dependable, economical service.

Insure care-free maintenance of water level in your heaters, tanks, reservoirs and other equipment by specifying "HERCULES."

HERCULES FLOAT WORKS
200 Franklin St.
SPRINGFIELD, MASS.

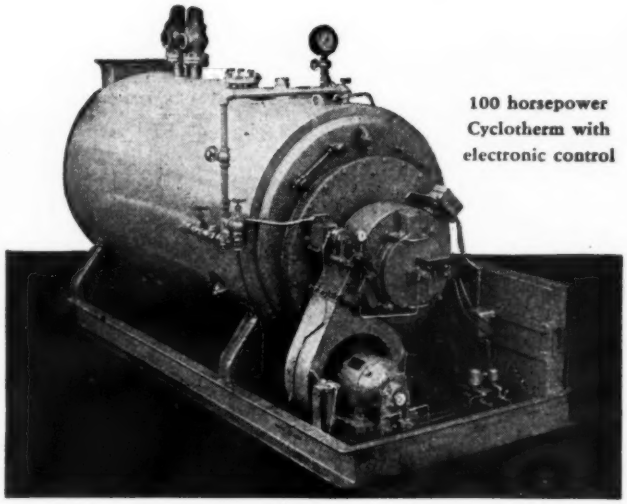
DOLLAR EFFICIENCY—work done per dollar spent—measures the value of steam generation

Exclusive principles of combustion and design have given Cyclotherm an outstanding record of efficiency and economy among steam generators. Because of its combustion principles and design, Cyclotherm meets the dollar efficiency test throughout its wide power range (10 to 300 horsepower) in units that are both oil and gas fired.

Whether used for power, processing or heating, a Cyclotherm makes an enviable record in steam production per unit of fuel consumed.

Cyclotherm Steam Generators are fully automatic, strongly built and fully self contained. They will give you years of trouble-free service for they are designed and constructed for exacting service with a minimum of attention.

While the range of available units obviously cannot be on a peacetime basis, if you are planning immediate replacement, our engineers will gladly cooperate in meeting your needs. Any additional information desired will be supplied promptly.



100 horsepower Cyclotherm with electronic control

CYCLOTHERM
STEAM GENERATOR

AMES IRON WORKS
OSWEGO . . NEW YORK . . BOX 602

ARMY E NAVY

AIR FILTER SERVICE

Dotting the nation from border to border and coast to coast are Air-Maze factory representatives. They are competent air filtration engineers trained, experienced, and ready to assist you with your air filtration problems.

Take advantage of this Air-Maze service because Air-Maze has specialized in engineered, precision-built air filters for twenty years. So, whether your interest applies to air conditioning, ventilating, compressors, blowers or engines, you can have *engineered air filtration* in every Air-Maze filter.

Typical Air-Maze Panel for heavy-duty service.

Air-Maze air filters are constructed of metal throughout. They are easily washable—last indefinitely. For further data on types and application send for catalog AGC-144. And remember—"If it uses air, use AIR-MAZE".

AIR-MAZE CORP. • CLEVELAND 5, O.

Representatives in Principal Cities. In Canada: Williams & Wilson, Ltd., Montreal, Quebec, Toronto, Windsor; Fleck Bros., Ltd., Vancouver.

IF IT USES AIR...USE

AIR-MAZE

ENGINEERED AIR FILTRATION

C. H. WHEELER
OF PHILADELPHIA

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AIR EJECTORS

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MECHANICAL DRAFT
COOLING TOWER

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DECK MACHINERY

C. H. WHEELER MANUFACTURING Co.
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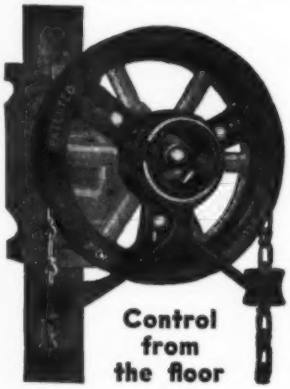
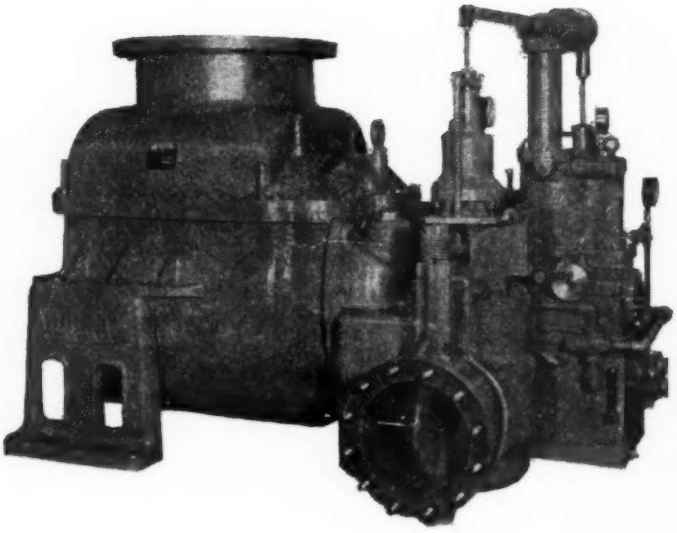
Make Your Overhead Valves SAFE And Easy to Reach---



With the Babbitt Rim for Valves you eliminate danger and banish the step ladder. You can now place your valves wherever they come economically and conveniently. They fit any valve. Let us tell you more about them. Write today.

BABBITT STEAM SPECIALTY CO.
New Bedford, Mass.

MURRAY
MULTISTAGE
STEAM TURBINES



Another MURRAY multistage steam turbine, designed to deliver 350 horsepower on low pressure steam at 5 pounds and exhausting to 26 inches Hg vacuum. It is provided with single inlet valve with 10 inch flange, and 24 inch exhaust facing up. This unit will pay for itself in a short time, since it utilizes what would otherwise be wasted energy, since an excess of low pressure steam existed.

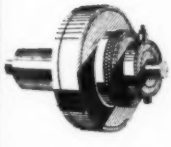
Equipment includes variable speed oil relay governor, butterfly type emergency trip valve, strainer surrounding the double seated balanced governor valve.

The complete MURRAY line of turbines includes all variations of mechanical drives, and turbine generator sets up to and including 2500 KW rating.

Sales Representatives for Murray products are located in all principal cities.

MURRAY IRON WORKS COMPANY
BURLINGTON, IOWA
Builders of Steam Power Equipment for Three Quarters of a Century

HE KNOWS WHAT'S RIGHT IN POWER DRIVES



He Is The Dodge Transmissioneer

He's a specialist in putting power to work, graduate of a factory course. That insignia on his lapel means he has proved his qualifications to prescribe the most efficient power drive to meet your needs. He can show you new and better ways to put *all* your power into the job.

His knowledge and experience are backed by America's broadest line of mechanical power transmission equipment — Dodge precision-built bearings, sheaves, pulleys, clutches and other drive components. Transmissioneered means advanced design in power drives.

Transmissioneering service is nation-wide — there are 210 Dodge factory graduate Transmissioneers in principal cities. Whenever you have a problem in power application, call a Transmissioneer — your local Dodge distributor. He has the latest answer. Often your immediate needs can be supplied from local stock.

DODGE MANUFACTURING CORPORATION, MISHAWAKA, INDIANA, U. S. A.

DODGE
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THE RIGHT DRIVE FOR THE JOB

Copyright 1945 Dodge Mfg. Corporation

RUST is a ROBBER!

Tectyl *Keeps It Out*

One Quick, Easy Precaution . . .

You take protective measures against theft of your valuable equipment or materials. Don't let *rust* ruin it right under your nose! You can STOP destructive corrosion by simply spraying, dipping, brushing, or flushing metal surfaces with Tectyl—it *seals* out moisture for as long as two years. Tectyl leaves a thin, transparent film; you can always see its protection. A little Tectyl covers a lot of metal, and comes off clean and quick with kerosene.

One of Five Specialized Types . . .

will fit your special need—whether you're packaging for overseas shipment, laying up for reconversion, or fighting rust in plant operation. Tectyl protection is tested, proven, *positive*. Write today . . . tell us your own corrosion problem, and we'll send you a Tectyl bulletin with complete application data.

TECTYL *Stops Rust*

VALVOLINE OIL COMPANY
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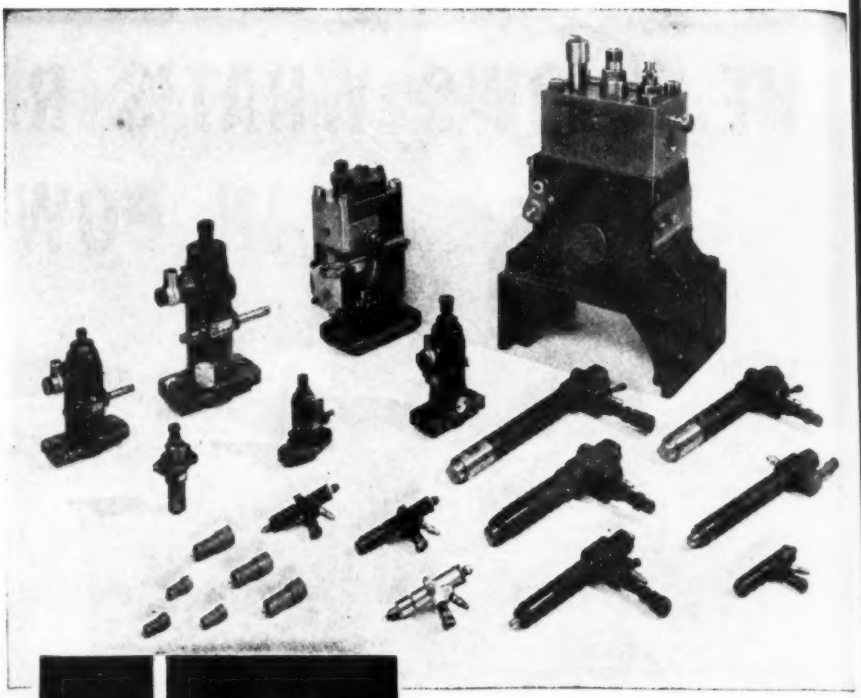
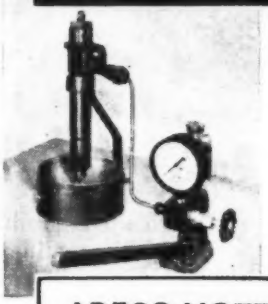
Refinery at Butler, Pennsylvania
General Offices, Cincinnati, Ohio
New York - Atlanta - Detroit - Chicago - Los Angeles
Vancouver - Washington, D. C.



adeco . .

YOUR SOURCE FOR DEPENDABLE FUEL INJECTION EQUIPMENT



Whether you need standard fuel injection equipment or special units built to your specifications, Adeco offers the logical source of supply.

Today's line of Adeco equipment, the outgrowth of long experience in serving the Diesel industry, includes: Standard fuel injection pumps in plunger diameters from 7 mm. to 31 mm.; a complete line of standard nozzles and nozzle holders, including the water-cooled type; and the Adeco nozzle tester.

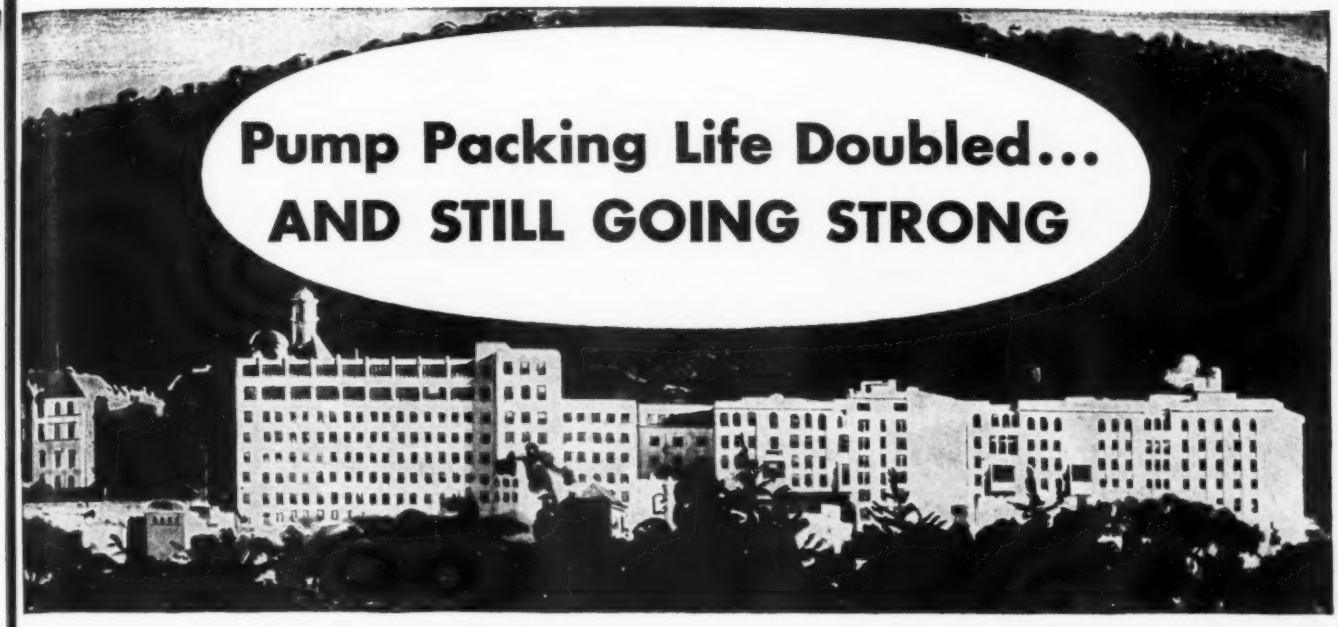
All Adeco products are built to highest standards, with years of trouble-free operation behind them to testify to their reliability.

ADECO NOZZLE TESTER

For Low-Cost Maintenance

America's most widely used nozzle tester enables any mechanic to make quick, accurate tests on injector opening pressure, spray pattern, etc., and detect stuck needle valves and leakage around valve seats. Compact, portable, sturdy, precision-built. Pressures up to 10,000 p.s.i. Tests both large and small injectors on bench or engine. Prevents costly delays and possible damage to engine. Standard or Navy-approved gauge. Ideal for testing hydraulic equipment. Write for bulletin.

ADEC
AIRCRAFT & DIESEL EQUIPMENT CORP.
4401 NO. RAVENSWOOD AVE. • CHICAGO 40, ILLINOIS



Pump Packing Life Doubled... AND STILL GOING STRONG

Summary: Darcova Pumcups now in 13th month of operation. Rings, formerly used, averaged six months service. Pump efficiency has increased so that pump speed has been reduced 6.6 strokes per minute.

Installation: University of California Medical Center, San Francisco, Calif.

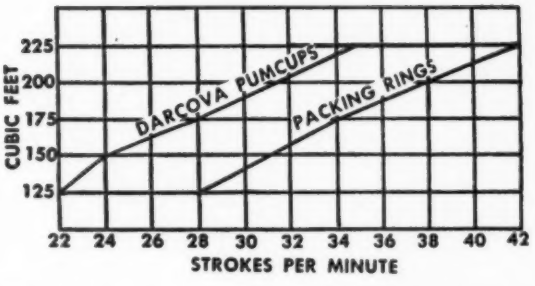
Equipment: Worthington Boiler Feed Pump, 7½ x 5 x 6.

Service: Twenty-four hour a day service, pumping boiler feed water at about 200° F. and under 150-lb. pressure.

Chief Engineer's Report: Mr. W. H. Dufton writes: "Approximately thirteen months ago we installed a set of your Darcova Pumcups and Pistons and are pleased to report that the original Pumcups are still in service.

"We had previously been using rock hard rings in this pump and had to replace them on an average of every six months.

"Being interested in the comparative efficiency of the two types of packing as well as their lengths of service run we ran carefully controlled tests wherein we metered the water pumped and counted our pump strokes. The graph chart (at right) gives the results."



The graph above shows how more than 300,000 pump strokes per month were eliminated by the higher pumping efficiency of Darcova Pumcups at the University of California Medical Center.

PRODUCT INFORMATION:
Darcova Pumcups are high quality, long-lived composition cups for packing pistons of reciprocating pumps, or hydraulic and air cylinders. They withstand service conditions that other materials will not, and their unique cup design reduces fluid slippage, increases pumping efficiency. Write us for further information or name of local distributors.

Pumcups are made in three textures—hard, medium and soft—available for most types and sizes of reciprocating pumps and air and hydraulic cylinders, from 1" to 20" diameter

DARCOVA
THE ORIGINAL COMPOSITION CUP

DARLING VALVE & Manufacturing Co.
WILLIAMSPORT, PA.

Darling Valve & Mfg. Co., Dept. E, Williamsport, Pa.

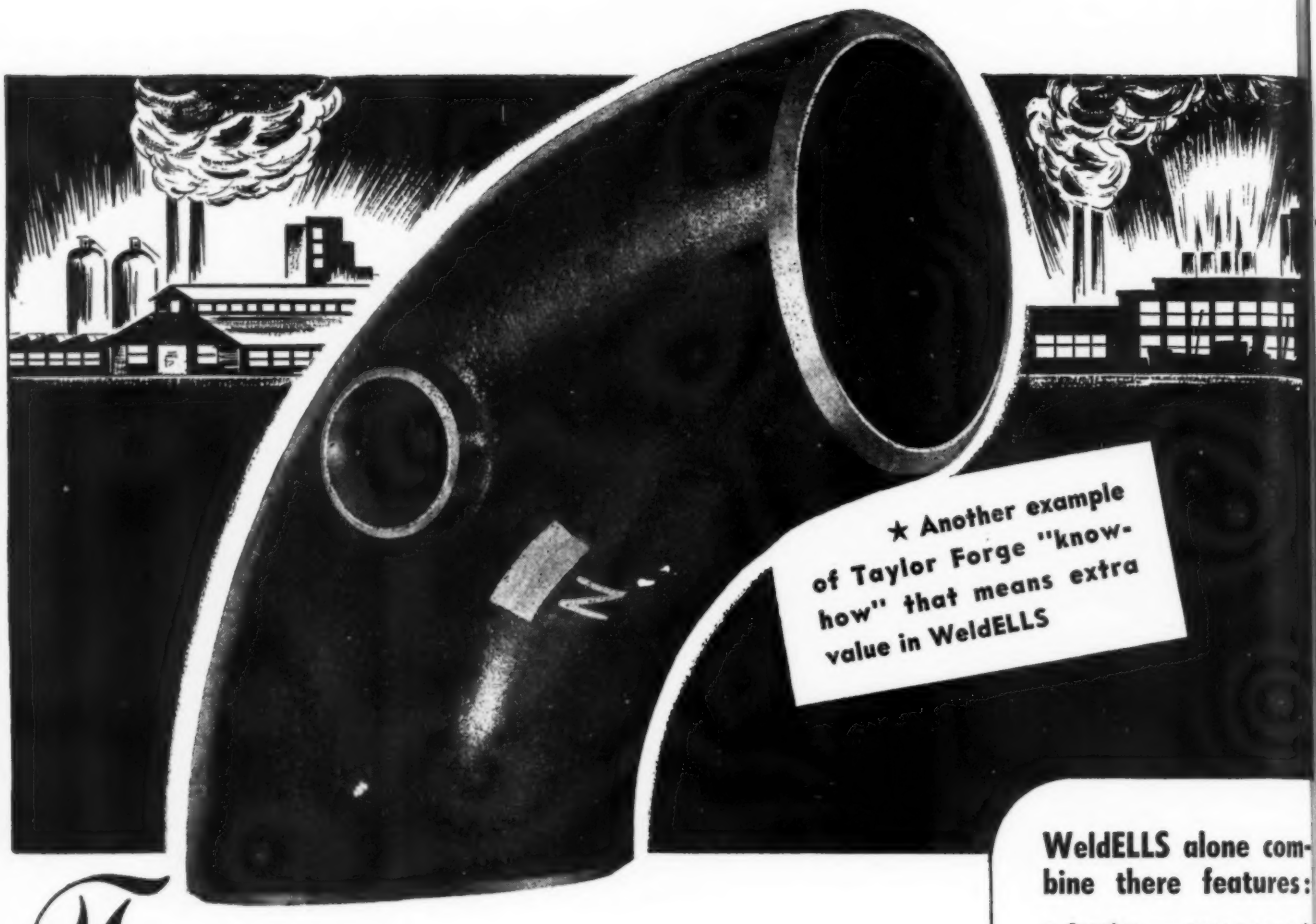
Gentlemen: I want to know more about Darcova Pumcups. Send your Bulletin 4401.

Name_____

Company_____

Address_____

City_____ State_____



They don't come much more special

★ You won't find a welding fitting like this listed in anybody's catalog. In addition to having integrally formed side outlets, probably never before provided in a welding elbow, these are "special" all the way — special steel, special size and special wall thickness.

Naturally we aren't out looking for unusual problems now. In normal times however we like to tussle with these tough assignments and even today we are glad to tackle them when the war effort requires.

★ Every one of the hundreds of problems like this that we have tackled and solved across the years has added its important bit to our knowledge of controlling hot metal under pressure and impact. And this accumulated "know-how" has found its best expression in our standard line of WeldELLS and other Taylor Forge Welding Fittings.

That is why you find features in WeldELLS that are not combined in any other welding fittings . . . tangents . . . extra metal distributed where strains are greatest . . . extremely accurate dimensions . . . just to mention a few that call for special processes and complete knowledge of forging technique. Check the list of features opposite and you will agree that in everything conducive to sound engineering and utmost economy in pipe welding—

WeldELLS alone combine there features:

- **Seamless** — greater strength and uniformity.
- **Tangents** — keep weld away from zone of highest stress—simplify lining up.
- **Precision quarter-marked ends** —simplify layout and help insure accuracy.
- **Selective reinforcement**—provides uniform strength.
- **Permanent and complete identification marking**—saves time and eliminates errors in shop and field.
- **Wall thickness never less than specification minimum** — assures full strength and long life.
- **Machine tool beveled ends** — provides best welding surface and accurate bevel and land.
- **The most complete line of Welding Fittings and Forged Steel Flanges in the World**—insures complete service and undivided responsibility.

WeldELLS have everything

TAYLOR FORGE & PIPE WORKS, General Offices & Works: Chicago, P.O. Box 485
New York Office: 50 Church Street • Philadelphia Office: Broad Street Station Bldg.

The Engineer Says

"WHAT A RELIEF!"

Many a power plant engineer has made this remark after installing GARLOCK Packings and Gaskets. No more leaks in boilers, pipe lines and pumps—and everybody's happy!

GARLOCK products give long, dependable service because they are manufactured in our own plant and are *quality-controlled* from raw material to finished product.

THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK

Manufacturers of GARLOCK *Packings, Gaskets and* KLOZURE *Oil Seals*

In Canada: The Garlock Packing Company of Canada Ltd., Montreal, Que.

GARLOCK 234 gives long, dependable service on rotary or centrifugal pumps handling hot water, cold water, caustic solutions or weak acids. All sizes from 1/8" to 1¼".

Garlock

HERE'S THE "Tiffany" OF High TEMPERATURE – High PRESSURE PACKING

Core: Vulcanized pure asbestos fibers, thoroughly graphitized.

Braided Asbestos Jacket: reinforced with monel wire.

JOHN CRANE Style 6-AM

Large steel plant, Youngstown, Ohio:

"6-AM installed in open hearth valves. No difficulty."

Cleveland steel mill:

"Open hearth valves still packed after 9 months. Exceptional service."

Large high-pressure power plant, Painsville, Ohio:

"Excellent service with steam on stop valves at 2000 p.s.i., 650° F. and superheated 300°. Have standardized on 6-AM."

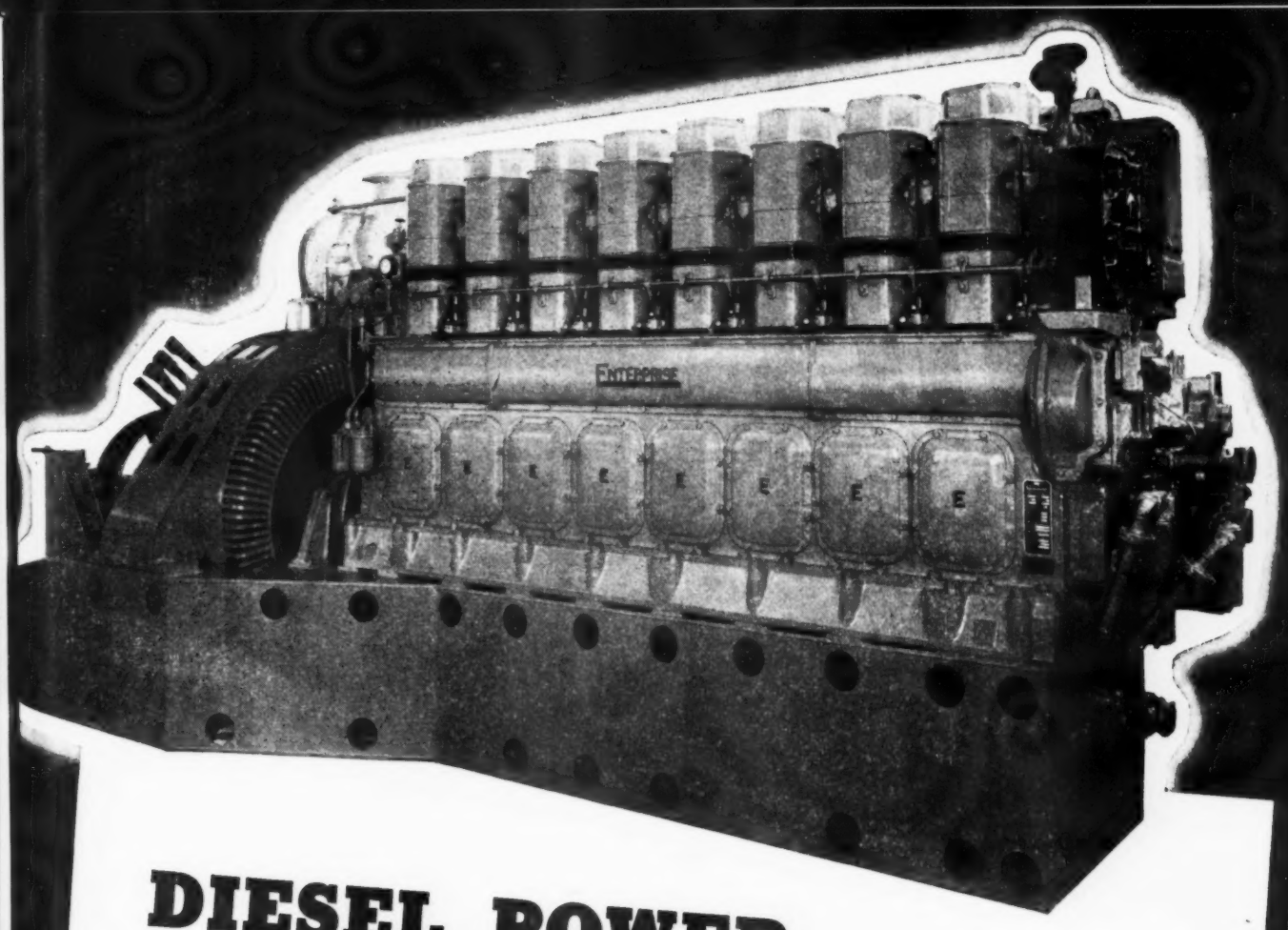
Operating Engineers: Order spirals, coils, spools, die-formed rings or sets.

CRANE PACKING COMPANY

1811 CUYLER AVE. • CHICAGO 13, ILL.

BALTIMORE, BOSTON, BUFFALO, CLEVELAND, DALLAS, DETROIT, HOUSTON, LOS ANGELES, NEW YORK, PHILADELPHIA, PITTSBURGH, SAN FRANCISCO, ST. LOUIS, TULSA

CRANE PACKING CO., LTD., Hamilton, Ontario, Canada. Branches: Montreal, Toronto, Vancouver



DIESEL POWER FOR MODERN INDUSTRY

Industries must face the post-war era with the assurance that their power facilities are adequate and economical. Enterprise Diesel Engines fulfill the demands of modern industry for peak output from production equipment or for power generation. Designed for unusual fuel and lubrication economies, Enterprise Diesels are proven power-plants that have gained noteworthy recognition for their ability to operate over long periods of sustained performance without maintenance and overhaul.

Since 1886 Enterprise has engineered meritable equipment for industry.

Ruggedly built and conservatively rated from 225 HP to 1450 HP to meet normal demands . . . Turbocharged to 2100 HP for above normal and intermittent needs, Enterprise 4-cycle Diesels fulfill operation requirements in all climates . . . at sea level or high altitudes. They are constructed in three essential sizes, each of which is built in 6 or 8 cylinders. Full engine enclosure seals out abrasive dust and grit. Enterprise Diesels have earned their place as power for modern industry.

New Illustrated Catalog No. 192 of late models gladly sent on request.

ENTERPRISE ENGINE & FOUNDRY CO.

SAN FRANCISCO
SEATTLE

Enterprise DIESEL POWER

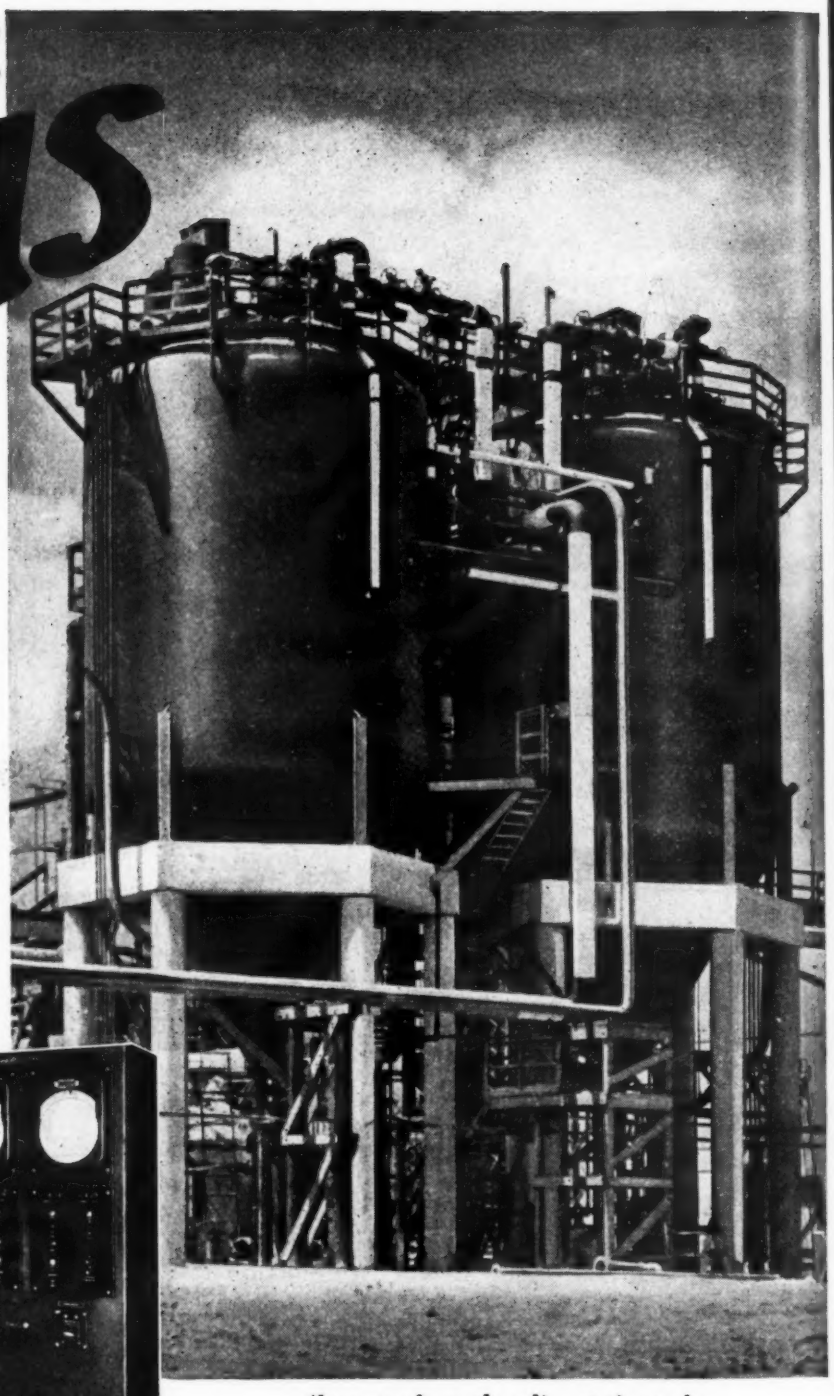
WASHINGTON, D.C.
NEW YORK

2 sets of TWINS

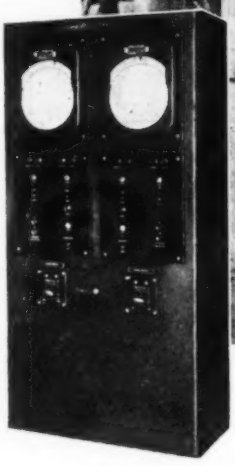
each with a capacity of

50,000 Gals. per Hr.

An interesting installation of Cochrane Deaerating Hot Process Softeners is that of a Southern oil company, which has erected two double-unit softeners, with a total capacity of 200,000 GPH. River water, already treated with coagulant and dolomitic lime in a preclarifying system, is introduced into the Softeners, which have 60° sludge cones. Reagents used are lime and soda ash. One installation uses Cochrane electrically operated proportioners to control individual chemicals; the other installation uses dry feeders. The battery of nine 10-ft. filters have individual valve nests so that they can be back-washed in the conventional way or with filtered water.



Above are shown the sedimentation tanks of one of the twin units. Note 60° sludge cones.



Panel Board with Flow Meter Control of Chemical Feed

COCHRANE CORPORATION ARMY E NAVY **3106 N. 17th ST., PHILADELPHIA 32, PA.**

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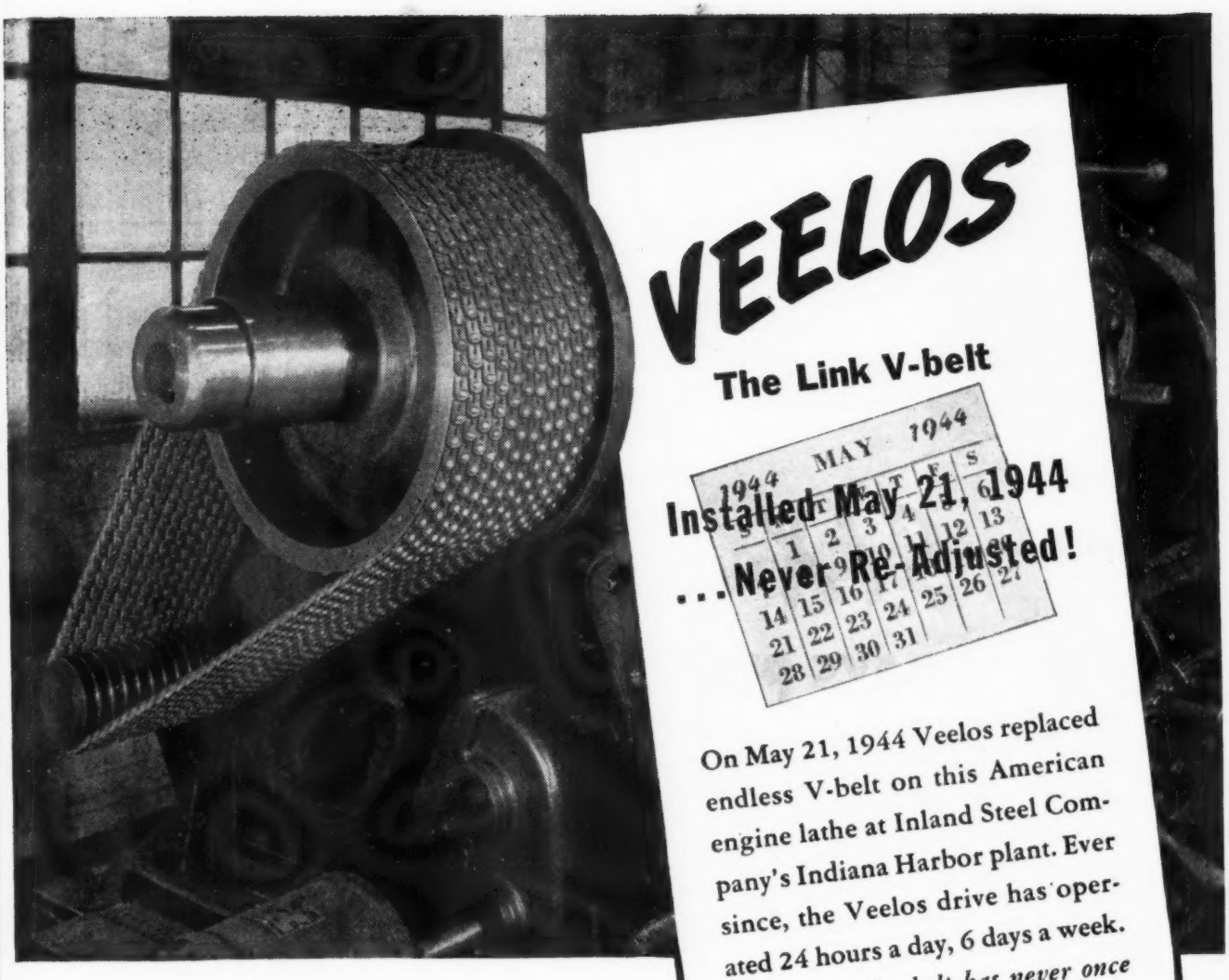
SOFTENERS • DEAERATING SOFTENERS • DEAERATORS • METERS • STEAM SPECIALTIES



VEELOS

The Link V-belt

Installed May 21, 1944
... Never Re-Adjusted!

On May 21, 1944 Veelos replaced endless V-belt on this American engine lathe at Inland Steel Company's Indiana Harbor plant. Ever since, the Veelos drive has operated 24 hours a day, 6 days a week. *Yet the Veelos belt has never once been re-adjusted.* That's a remarkable record!

In Every Type of Industry...
as In the Steel Industry...
Link Construction Ups Production

Link construction of Veelos turned the trick at Inland... and link construction makes Veelos the most adaptable of V-belts for any drive. Quick, easy tension adjustment ends slippage ...keeps machinery running at full speed and productivity.

One drive of Veelos will point the way to production increases and power savings throughout your plant. Write today for free Veelos manual giving complete details.

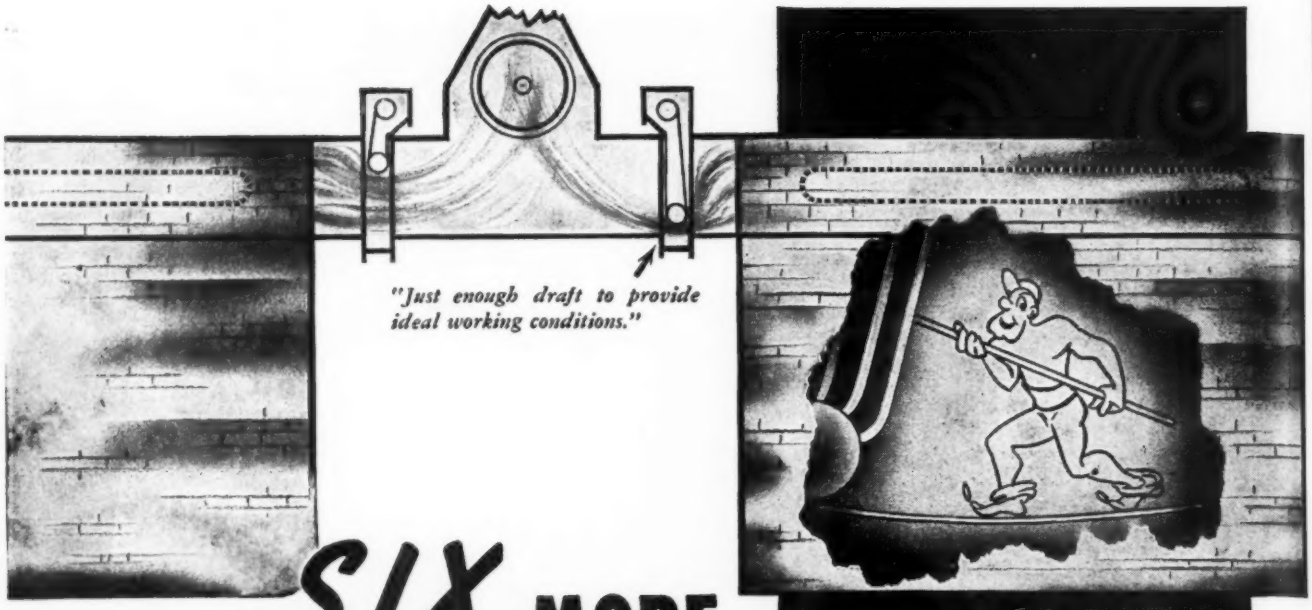
MANHEIM MANUFACTURING & BELTING CO.
MANHEIM, PENNSYLVANIA

Simple as Buttoning a Shirt

Get the "hang" of it, and you'll couple and uncouple Veelos as easily as you button your shirt. This unique, link construction is the big reason why *production goes up when Veelos goes on.*

VEELOS
THE LINK
V-BELT

Adjustable to any Length
Adaptable to any Drive



SIX MORE OPERATING DAYS PER YEAR

HEACON Dampers are reducing outage time by improving working conditions for the maintenance crew.

"That Heacon Damper," states one engineer, "makes it possible to regulate just enough draft to provide ideal working conditions inside the boiler. In that waste heat boiler which must be cleaned every sixty days," he continues, "I can get anything from a zephyr to a storm, quickly and accurately. As a result my crew finishes at least a day sooner and we get six more operating days per year."

Such control to a desired requirement is only possible with a tight, easily controlled damper such as the Heacon. A damper unique in design and outstanding in performance. Write for the latest booklet on Heacon Dampers or call the office nearest you.

THERMIX ENGINEERING COMPANY
Project and Sales Engineers
FIRST NATIONAL BANK BLDG., GREENWICH, CONN.

HEACON GIVES CONTROLLED FLOW

1. MORE RELIABLE OPERATION
2. INCREASED CAPACITY
3. REDUCED MAINTENANCE
4. GREATER FLEXIBILITY
5. HIGHER EFFICIENCY
6. BETTER REGULATION
7. LOWER BANKING LOSSES
8. QUICKER STARTING
9. SAFER OPERATION
10. CLEARANCE WITHOUT LEAKAGE

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On the Dynamatic variable speed coupling
IN THE BOEING WIND TUNNEL

Here's an electronically controlled Variable Speed Coupling that's in the middle of a tough job in the Boeing Wind Tunnel. It's located between the 18,000 h.p. synchronous motor and the 24-foot, seven-ton fan. Thus, it is possible to maintain any desired speed within one-tenth of one revolution per minute . . . to reach a maximum horsepower of 18,000 at 500 r.p.m.

Dynamatic engineers selected SKF Bearings for this unit. They used the new SKF Spherical Roller Thrust Bearing to carry full propeller thrust load. Consequently, they made certain of high bearing capacity, complete self-alignment and low friction for dependable performance at all times—even under the most adverse operating conditions. The tougher the job, the stronger the proof that SKF puts the right bearing in the right place.

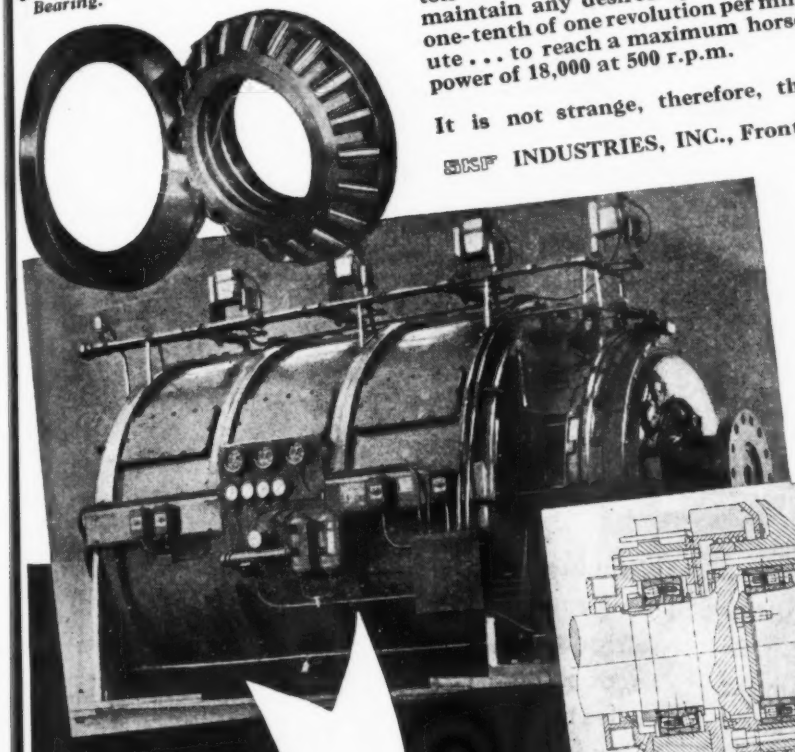
5785

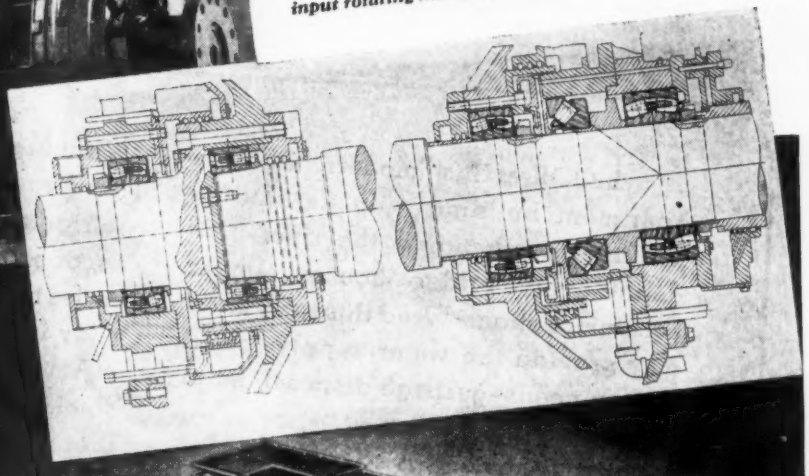
It is not strange, therefore, that

SKF INDUSTRIES, INC., Front Street & Erie Avenue, Philadelphia 34, Pa.

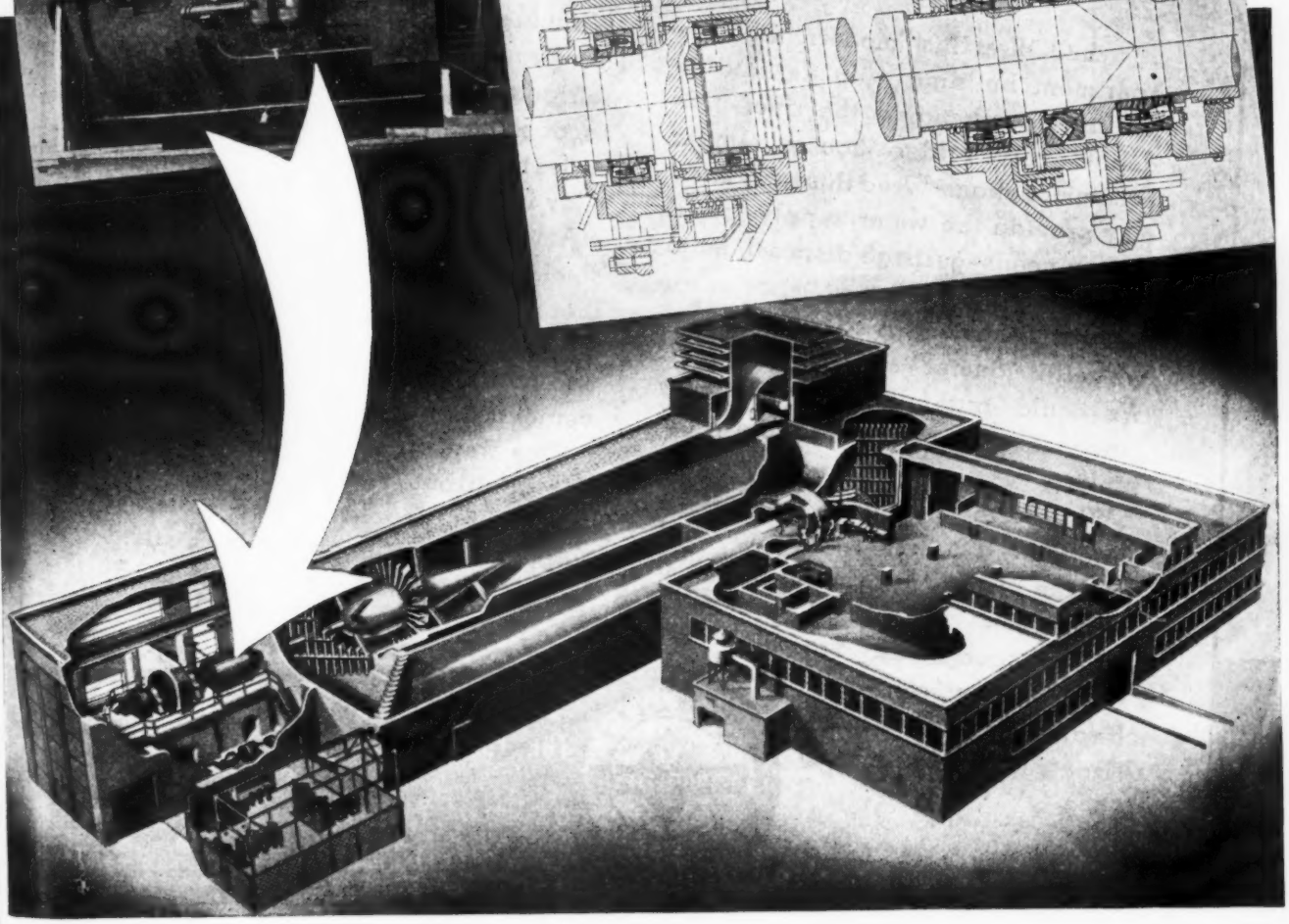
SKF
ROLLER BEARINGS

● *The SKF Spherical Roller Thrust Bearing.*

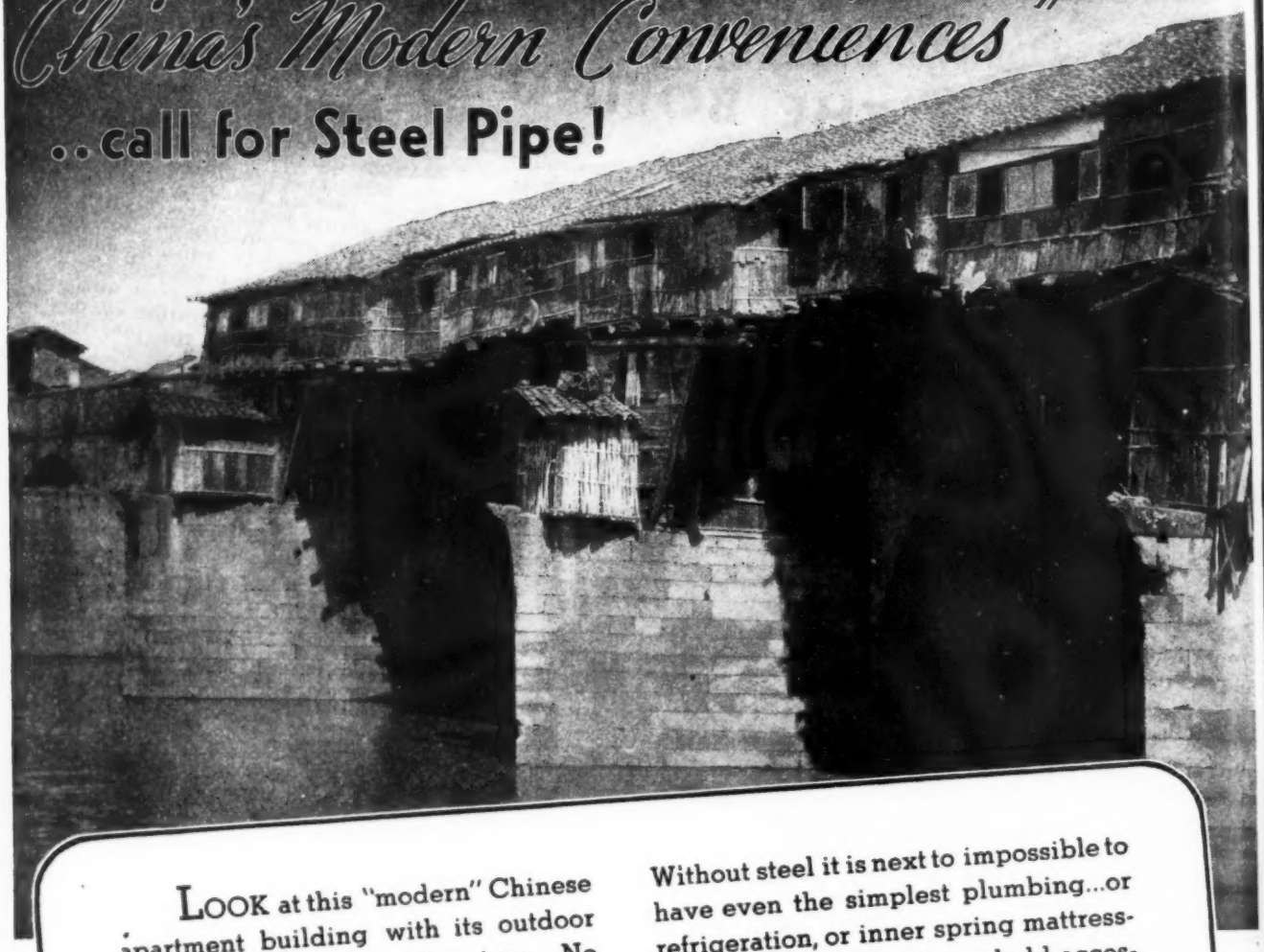




● *Built by* DYNAMATIC CORPORATION, *this eddy current Variable Speed Coupling weighs 110,000 lbs.; output rotating member, 50,000 lbs.; input rotating member, 18,000 lbs.*



China's "Modern Conveniences" ..call for Steel Pipe!



LOOK at this "modern" Chinese apartment building with its outdoor facilities overhanging the river. No doubt every bridge houses similar accommodations. And this same river may provide the water supply for all human needs--garbage disposal, laundry, bathing, drinking.

Oriental housing is so different that we call it "quaint" and "picturesque". We could truthfully describe it as "inconvenient", "uncomfortable", "unsanitary"

Why do the people of the East endure this? Do they prefer to drink unclean water, to wash and bathe in primitive ways?

No, of course, not. You know the answer. Their backwardness is due in large part to lack of steel. Without steel it is next to impossible to have even the simplest plumbing...or refrigeration, or inner spring mattresses, or scores of other household accessories that help make living in America a joy instead of a burden.

America's well-being depends on steel. When war's demand is ended, there will be steel enough for present American homes to be modernized and new ones built...with modern conveniences never even known before.

One way in which we Americans can contribute to lasting peace is to help other peoples of the world to appreciate and enjoy the high standards of living that steel makes possible.

QUALITY YOUNGSTOWN SERVICE

YOUNGSTOWN

THE YOUNGSTOWN SHEET AND TUBE COMPANY

YOUNGSTOWN, OHIO

Manufacturers of

CARBON · ALLOY AND YOLOY STEELS

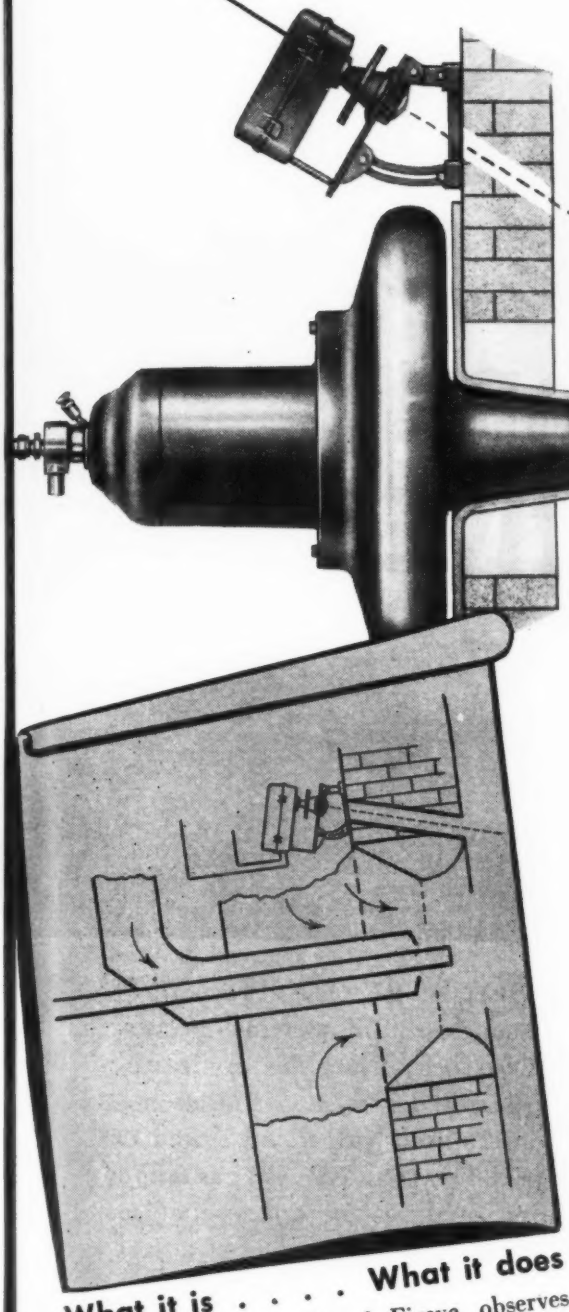
Pipe and Tubular Products - Sheets - Plates - Conduit - Bars - Coke Tin Plate - Electrolytic Tin Plate - Rods - Wire - Nails - Tie Plates and Spikes.

Acting with the speed of light

fireye

PREVENTS EXPLOSIONS

in oil and pulverized coal burners



Those first vital seconds following flame failure can determine whether you'll still have a boiler . . . *or an explosion.* Why? Because fuel, under pressure, can fill the combustion chamber very, very quickly, changing it from an efficient heating apparatus to a powerful bomb crowded with a highly explosive mixture. A stray spark, hot refractory, or the simple act of relighting under these conditions may easily result in serious damage and loss of life.

Fireye acts with the speed of light to prevent explosions in oil and pulverized coal burners. Rays from the flame itself are focused directly upon Fireye's sensitive photoelectric cell. Should the flame fail, Fireye will react instantly to shut off the fuel . . . sound an alarm . . . or energize a complete programming relay for fuel pump and valve operation.

F-3

For full details write for Catalog 50
. . . on your letterhead, please.

★ ★ ★

What it is . . . . What it does

The photoelectric cell of Fireye observes pilot, main flame or both through a small window in the wall of the fire chamber.

Fireye equipment is a self-contained unit of proved performance, easily installed — a moderate investment that is paying a high return in greater safety in installations throughout the country.

FIREYE ELECTRONIC BOILER FEEDWATER CONTROLS are floatless and maintenance-free. They maintain desired water level automatically — provide low-level alarm and fuel cut-off. Write for Catalog 51.

COMBUSTION CONTROL CORPORATION

Cambridge 42, Mass. · District Offices in all Principal Cities

PHOTOELECTRIC fireye **FLAME SAFEGUARD**

RUST—a nuisance and a very costly menace in many plants no longer need be tolerated. Laboratory magic has furnished its master.

New Sinclair products, developed to solve tremendous military rust problems, are now available for your plant problem.

Sinclair RUST-O-LENE B for exposed metal surfaces of machinery in operation, in storage, or in transit

- *provides a firmly-adhering rust proofing film*
- *prevents rusting of clean surfaces*
- *halts further rusting of corroded surfaces*
- *has lubricating qualities*
- *defies any degree of moisture from mere dampness to heavy rain*
- *can be readily removed when desired*

Sinclair OPALINE RP (Rust Preventing) OILS for enclosed oil systems, prevent internal rusting of engines, hydraulic systems, gear reducers, and similar machinery intermittently operated, stored, or transported. OPALINE RP also has ample lubricating qualities for temporary use.

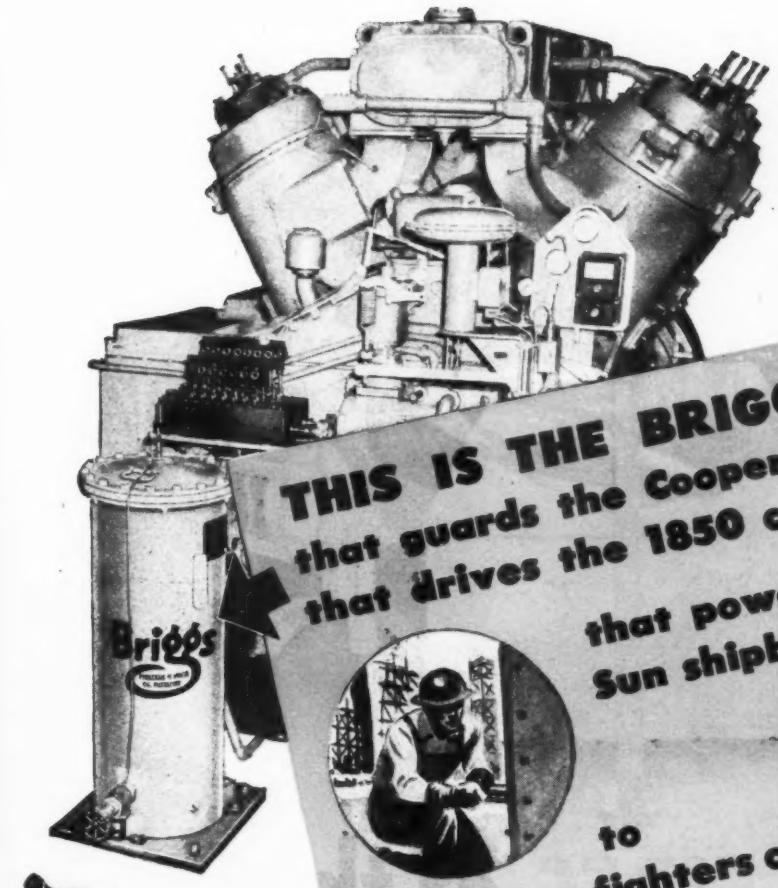
Both these remarkable Sinclair rust-preventives have successfully passed the most exacting service tests, and fully meet Government specifications.

Learn how RUST-O-LENE B and OPALINE RP can combat rust for you. Write for brochure giving full details.

SINCLAIR INDUSTRIAL OILS

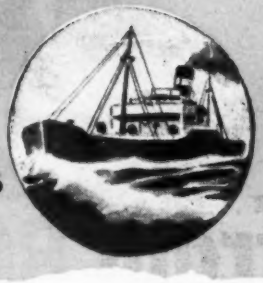
FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE SINCLAIR REFINING COMPANY, 630 FIFTH AVENUE, NEW YORK 20, N. Y.

Rust-O-Lene—Opaline Reg. U. S. Pat. Off.



THIS IS THE BRIGGS CLARIFIER...
that guards the Cooper-Bessemer Diesel...
that drives the 1850 cu. ft. compressor...
that powers the tools of Sun shipbuilders who build ships

to supply our fighters overseas



For over 18 months this Briggs Lube Oil Clarifier has protected this most important piece of equipment at the Sun Shipbuilding and Drydock Company, Chester, Pa.

Operated 100 days a year at 100% operating load . . . moving parts of the engine show no visible signs of wear since the Briggs Oil Clarifier was installed. Refills and oil are changed at 2000 hours . . . it is not necessary to clean the lube oil system when putting in new oil.

Such dependability and time-saving help the Sun Shipbuilding and Drydock Company to "keep 'em sliding down the ways."

Wherever equipment breakdown would interrupt production—THERE'S THE PLACE TO INSTALL A BRIGGS OIL CLARIFIER!

Available in both lube oil and fuel oil models—for every size and type internal combustion engine—for hydraulic oils, turbine oils, etc.!

A Briggs distributor will tell you WHY and HOW Briggs Oil Clarifiers save money, protect equipment, eliminate loss of valuable man hours. Call him—he's listed in the "Filter" section of your classified telephone directory or—write manufacturer for literature on the complete Briggs line.

Briggs
PIONEERS IN MODERN OIL FILTRATION

BRIGGS CLARIFIER CO.

General Offices, Washington 7, D.C.

BRIGGS FULLERS EARTH TYPE CARTRIDGES GIVE YOU 3 TIME-3 WAY FILTRATION—
Remove invisible as well as visible contaminants—maintain oil in "refinery-pure" condition.

BRIGGS DISCEL (All-Cellulose Type) Cartridges are manufactured of specially-processed cellulose for effective filtration of additive type oils.

WE KNOW THE PIPING PROBLEMS

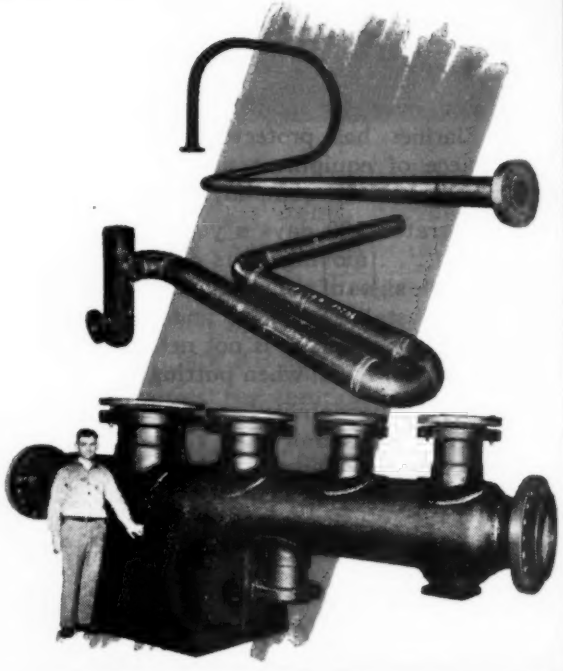
from BOTH SIDES of the Desk

Midwest not only fabricates piping for all purposes, but also operates an experienced contracting department that will deliver to the customer a completely installed piping system—ready for operation. Consequently, we have a clear view of piping problems from both sides of the desk.

Our contracting department is ever ready to make *practical* suggestions for improving pre-fabricated piping subassemblies. This continuous interchange of information and suggestions helps keep the entire Midwest organization on its toes; it is important in maintaining the high quality of Midwest piping.

Our contracting department is in constant and intimate touch with piping users in all types of industry. Changes in piping requirements . . . changes in the thinking of users are quickly relayed throughout the entire Midwest organization.

Midwest has four modern pipe fabricating plants strategically located to serve you . . . whether you need a simple bend or piping for an entire plant completely erected and ready for operation.



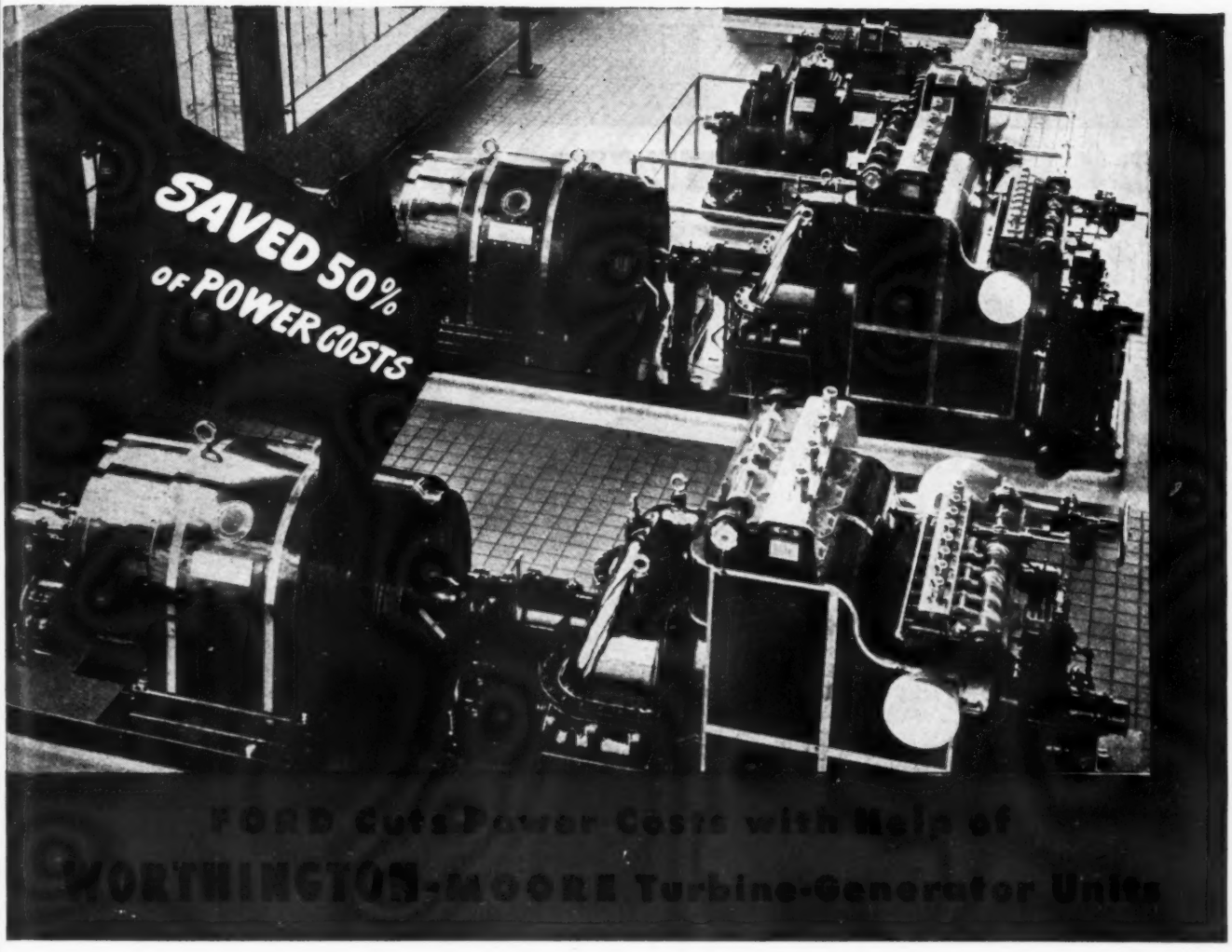
MIDWEST

PIPING & SUPPLY CO., INC.

Main Office: 1450 South Second St., St. Louis 4, Mo.

Plants: St. Louis, Passaic (N. J.) and Los Angeles • Subsidiary: Lumsden & Van Stone Co., South Boston 27, Mass. • Sales Offices: New York 7—(Eastern Division) 30 Church St., Chicago 3—645 Marquette Bldg. • Los Angeles 33—520 Anderson St. • Houston 2—229 Shell Bldg. • Tulsa 3—533 Mayo Bldg. • Atlanta 3—Red Rock Bldg. • South Boston 27—426 First St.

Piping Fabricators and Contractors



Power costs have gone down 50% in the Ford Motor Company's Chicago power plant near the Calumet River. This is another example of how *modern* automatic extraction type turbines can cut power costs, far below costs of older methods of power generation. Superintendent reports "excellent service record during the period since installation with no interruption."

Engineered to Fit the Job

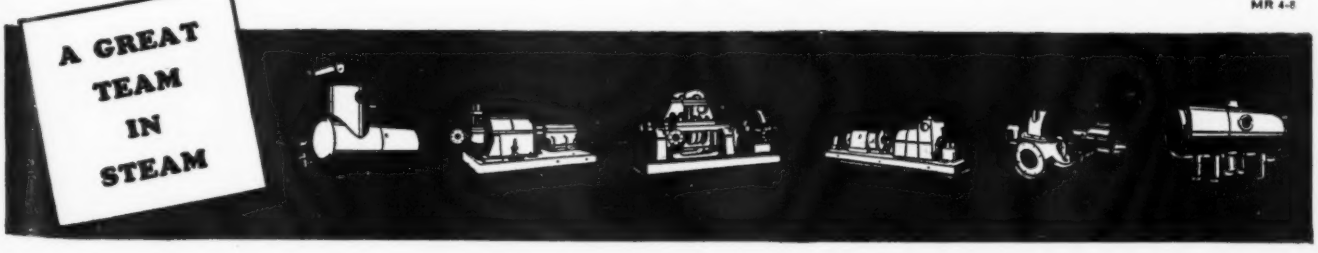
Taking 225 lb. 525° steam at the throttle, the Worthington-Moore turbines exhaust to the condensers, and automatically extract steam at 5 lbs. pressure to satisfy variable process and heating steam requirements.

Investigate WORTHINGTON-Moore Teamwork

In many other turbine-generator installations, firms like yours have profited from Worthington's broad experience with steam power plant equipment, plus Moore's years of turbine engineering and manufacture. Write us, or call our nearest district office. *Worthington Pump and Machinery Corporation, Moore Steam Turbine Division, Wellsville, N.Y.*

WORTH BEHIND THE NAME
WORTHINGTON

MR 4-8



DE LAVAL PROTECTION...
an important safeguard to
UNINTERRUPTED OPERATION

De Laval "Uni-Matic" at the Southwest Sewage Treatment Works, Sanitary District of Chicago, Stickney, Ill.

THE protection afforded by De Laval centrifugal Oil Purifiers against the troubles caused by dirty lubricating oil is a very important factor in making uninterrupted operation possible. Fortunately, in these times when most power sources cannot be spared from everyday duty, the great majority of the larger turbines in this country already have De Laval protection, as do hundreds of smaller turbines and other prime movers.

De Laval centrifugal Oil Purifiers enable a portion of the oil to be continuously by-passed, removing water and dirt and markedly retarding the formation of sludge. When the oil is thus purified, danger of bearing failure is practically eliminated. Trouble with other parts lubricated from the circulating system likewise is virtually abolished when oil is purified by De Lavals.

Whether a De Laval Oil Purifier by itself is used, or, in the case of turbines, a complete De Laval-Funk Process, the oil is maintained in a condition most nearly approaching that of new oil. Investigate for yourself these and other advantages of De Laval centrifugal purification . . . no obligation.

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6

DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 19

THE DE LAVAL COMPANY, Limited
MONTREAL PETERBOROUGH WINNIPEG VANCOUVER

DE LAVAL OIL PURIFIERS

FOR MORE DEPENDABLE POWER PRODUCTION

DEARBORN ENGINEER
GETS RIGHT DOWN TO WORK
in your boiler room
By anticipating undesirable effects of using raw or improperly treated water and initiating preventive treatment, Dearborn engineers head off water troubles right in your boiler room. As a result, damage to your equipment is prevented; boiler operating periods are extended to the maximum of efficiency.
Each engineer brings his own special laboratory apparatus for testing and sets it up for action. He holds constant consultation with the home laboratories, where proper chemical treatments are formulated for you and control methods recommended. Nor does his service end when you install the necessary equipment; he continues to call regularly to assure trouble-free boilers for all time.
Call the Dearborn Engineer in your vicinity, or write direct.
DEARBORN CHEMICAL COMPANY
Dept. D
310 S. Michigan Ave.
Chicago 4, Illinois
Dearborn
TRADE MARK REGISTERED
BOILER WATER TREATMENT AND SERVICE

"It's not too difficult to get replacement parts

--it's the lost time and nuisance of repairs that bothers us"

Engineers and plant operators from coast to coast have just confirmed the value of what Bigelow-Liptak has been doing for its customers for years. In a series of reports of interviews with plant operators and equipment users, conducted by a leading engineering journal, this remark kept coming back, "We don't have too much difficulty getting replacement or repair elements. It's the trouble, extra work and loss of time that hits us hardest." These men know the importance and economy of equipment that can be depended upon to give the service it is designed for, day after day.

This is exactly what Bigelow-Liptak engineers have always kept foremost in their minds when designing heat enclosures of all types. The availability of a boiler, oil still or billet heating furnace over a long continuous operating period is a vital part of the solution to the whole problem. It's the overall service and availability of the enclosure that counts.

A Bigelow-Liptak Engineer Is a Good Man to Know

With today's need for plant equipment that will stay in operation, you need expert counsel more than ever in discussing your industrial furnace enclosures. The list of companies for which Bigelow-Liptak has designed enclosures reads like a Who's Who in American Industry. In the long list are included every type and size of enclosure in which thermo-dynamics, ceramics and mechanics of materials are factors.

It will pay you to discuss your heat enclosure problem with Bigelow-Liptak—if you want enclosures that will give service and economy over a long continuous operating period.

Get in touch with a Bigelow-Liptak engineer.

Who is Bigelow-Liptak?

Bigelow-Liptak develops and designs heat or furnace enclosures—enclosures that are individually engineered for the user's own needs—not toward the false economy of a low initial cost—but to provide long, dependable service and economy of operation.

Enclosures for your industrial furnaces are the parts most subject to wear and tear. They enclose the combustion which is the working force of the particular heat machine involved—and as such their length of satisfactory service (availability) determines the effectiveness of the furnace itself.

BIGELOW-LIPTAK

BIGELOW LIPTAK Corporation

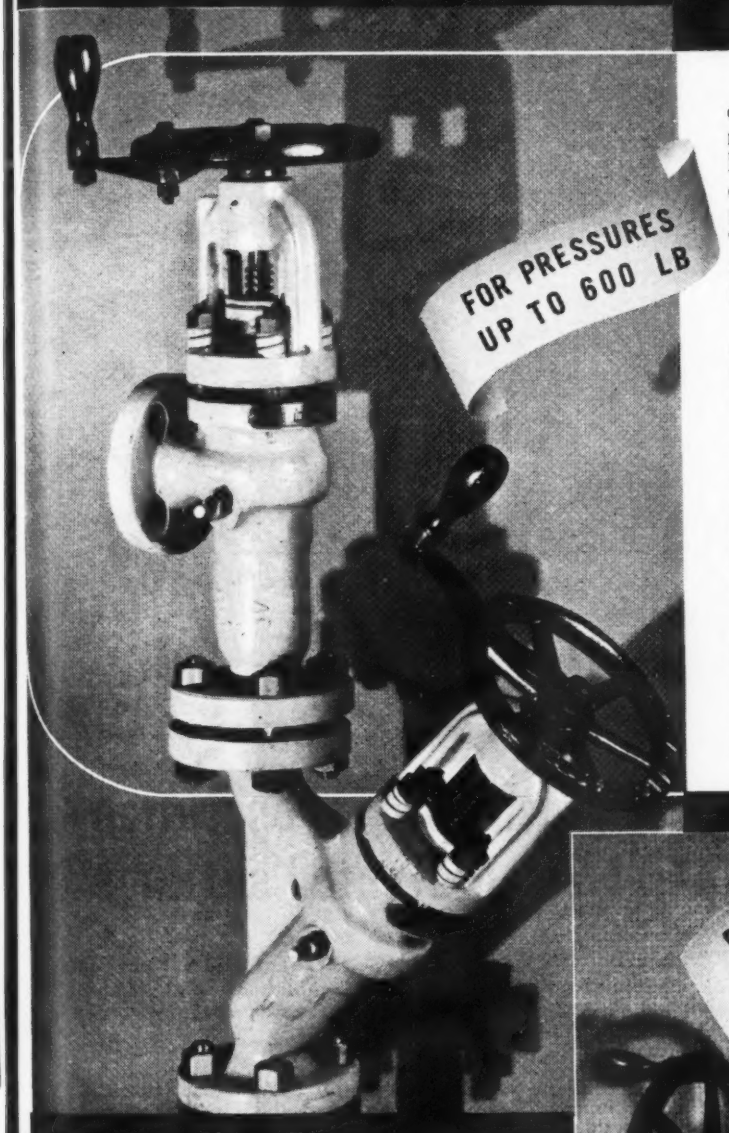
Unit-Suspended Walls + Arches

BIGELOW-LIPTAK CORPORATION
DIVISION A. P. GREEN FIRE BRICK CO.

330 Curtis Building — DETROIT 2, MICHIGAN

A Unit-Suspended Wall & Arch for Every Furnace

A Blow-off Valve Service
FOR ALL INDUSTRY



Nearly 40 years of laboratory and field experience, and continuous mechanical and metallurgical research, concentrated on the Blow-Off Valve requirements of power plants of all sizes, pressures and operating practices—have produced the Yarway *Seatless*-Tandem and *Unit*-Tandem Valves—the overwhelming preference of steam plant operators, today.

In fact, among the higher-pressure, pacesetting plants which have been built during the past ten years, it is the exception that is not Yarway-equipped.

When you plan a new plant or an extension—remember that your capital investment in major equipment warrants your insistence on the finest auxiliaries to protect that investment. And if you do, your natural Blow-Off Valve selection will be Yarway—the nation's choice.

Write for Catalog: Section B-432 for pressures up to 2500 lb; Section B-424 for lower pressures.

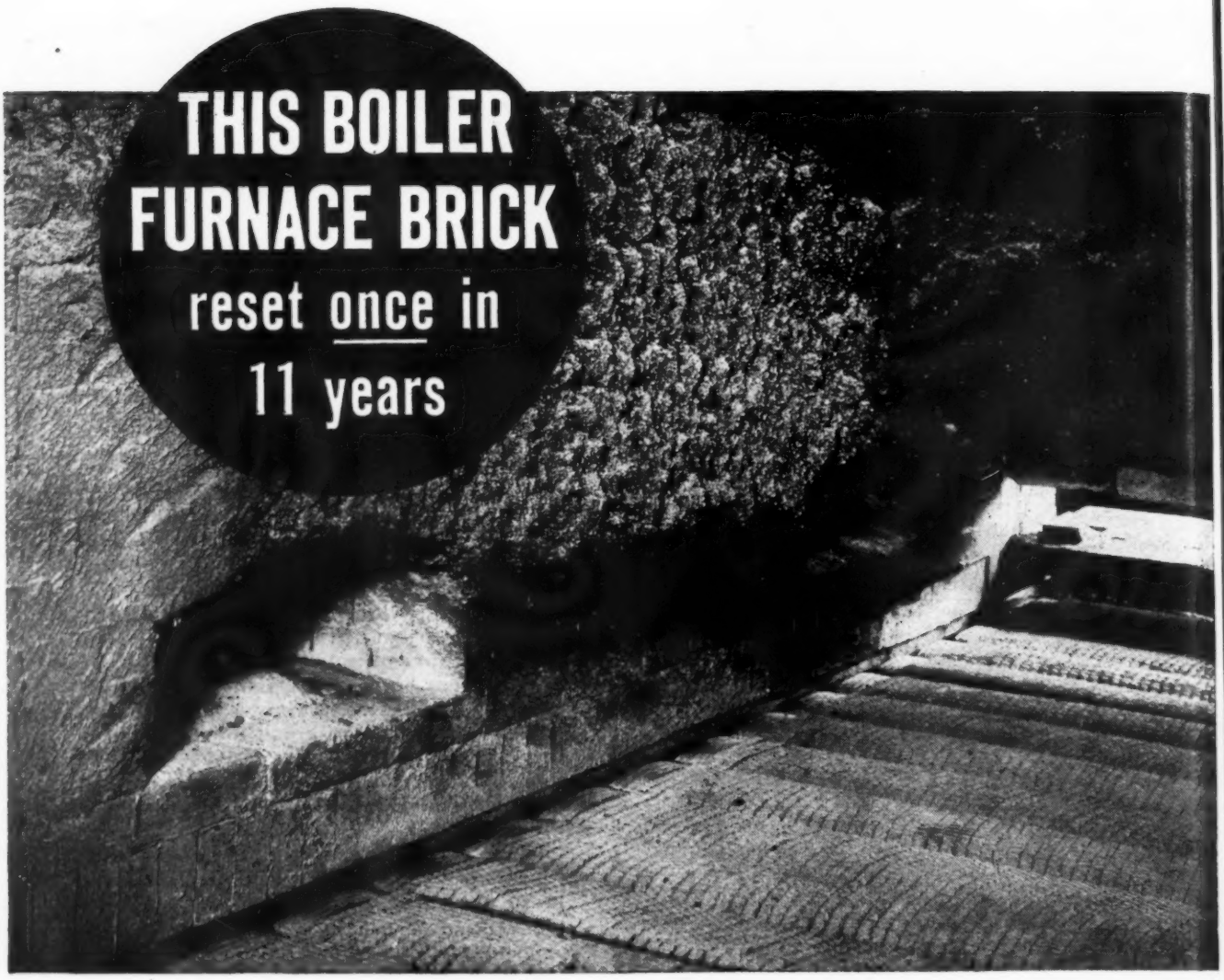
Ask about the new Yarway color and sound motion picture, available for group showings.

YARNALL-WARING CO. 100 Mermaid Ave., Phila. 18, Pa.

Yarway *Seatless*-Tandem with no seat to score, wear, leak. Standard in over 12,000 plants. Ideal for service where high concentrations are encountered and on pressures up to 600 psi.

Yarway *Unit*-Tandem equally suited for blowing or draining and for sealing on highest pressure service. Combines a Hard-Seat (blowing) and Seatless (sealing) Valve in a single, rugged, one-piece, forged steel body. For pressures up to 2500 psi.

YARWAY BLOW-OFF VALVES



An example of improved continuity in operation, assured by "CARBOFRAX" brick-protected settings.

THE picture shows "CARBOFRAX" silicon carbide brick after 11 years' service in a fuel bed of a 550 H.P. Heine boiler equipped with a Coxe Stoker. This furnace operates at an average rating of 200%, burning a mixture of rice and barley anthracite. During this period the brick were reset only once and then the original brick were used again.

Here is just one instance to show how "CARBOFRAX" brick provide continuous on-line service in boiler furnace settings.

"CARBOFRAX" brick do not burn or cut back. They are highly resistant to both flame erosion and mechanical abrasion. They also possess a high refractoriness. Clinkers have no chance of becoming embedded in the hard, dense face of this brickwork. Hence, it is unharmed during the barring and cleaning operation.

With a good foundation for the upper walls assured—with long-lived "CARBOFRAX" brick in the punishment zones—frequent outages caused by lining failures are eliminated.

Call in one of our refractories engineers to explain fully the advantages of "CARBOFRAX" brick-lined boiler settings. He'll be glad to describe how you, too, can profit by their use. The Carborundum Company, Refractories Division, Department J2, Perth Amboy, New Jersey.

"CARBORUNDUM" and "CARBOFRAX" are registered trade marks of, and indicate manufacture by, The Carborundum Company.

Super Refractories by CARBORUNDUM TRADE-MARK

WE PUT THE MILKMAN ON OUR PAYROLL

EVERY DAY—at the fatigue point in each shift—every Thermoid employee is served a container of energizing milk. And the workers enjoy a relaxing "seventh inning stretch" as the containers are handed around at machine, bench and desk.

How did we come to put the milkman on our payroll?

One answer is found in the results of his visits . . . the noticeable improvement in the health of both plant and office workers . . . the steady decline in fatigue-born accidents . . . the equally steady, over-all rise in the quality of Thermoid production.

Another important reason, however, was the unique spirit of cooperation that governs all activities here at Thermoid. Long ago, we learned that the sides of the business triangle—the employer, the employee and the customer—are held together by common interests; and retarded functioning of one impairs the useful strength of all.

Thus, the idea of free milk each shift is neither paternalism nor soft persuasion in the minds of Thermoid workers; but is welcomed by them as a common sense way of meeting a mutual problem. And that is the spirit that makes our customers say: "It's Good Business To Do Business With Thermoid."

Thermoid Rubber

DIVISION OF THERMOID COMPANY

TRENTON, NEW JERSEY

THE THERMOID LINE INCLUDES: **TRANSMISSION BELTING • F.H.P. AND MULTIPLE V-BELTS AND DRIVES • CONVEYOR BELTING • ELEVATOR BELTING • WRAPPED AND MOLDED HOSE • SHEET PACKINGS • INDUSTRIAL BRAKE LININGS AND FRICTION PRODUCTS • MOLDED HARD RUBBER AND PLASTIC PRODUCTS.**

IT'S GOOD BUSINESS TO DO BUSINESS WITH THERMOID

NO MORE *SUNDAY WORK*

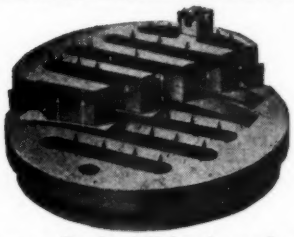
Now Worthington Compressor Engineers announce the development of new-type frame bearings and connecting rods for type DC motor-driven, type OXP duplex steam-driven, and angle gas engine driven compressors.

With pressure lubrication on most sizes, this latest refinement in compressors permits heavy-duty continuous service, without any of the Sunday maintenance work commonly required by obsolete wedge adjustable bearing designs. Also avoids expensive accidents resulting from broken wedge bolts. Save outage, man-hours, maintenance time . . . it all adds up to a big saving in operating expense.

Once again . . . as in the development of Feather* Valves, Worthington compressor engineering leads the way toward *better* compressor performance. Write for complete details . . . Publications Department, Harrison, N. J. *Worthington Pump and Machinery Corporation, Buffalo Compressor Division, Buffalo, N.Y.*

WORTHINGTON *BEHIND THE NAME* **WORTHINGTON**

WORTHINGTON ADVANCES COMPRESSOR DESIGN



The famous Feather* Valve is another example of Worthington compressor pioneering.

TIGHTER—valve is made tight by the pressure on the thin flexible strips.

SIMPLER—no buffer plates or cushioning devices.

QUIETER, SAFER—at high speeds—light, contact seating.

LESS FRICTION—flexibility, large lift area, contact seating.

ACCESSIBLE—valve removed within five minutes.

LOWER MAINTENANCE—valve practically indestructible; intake and discharge valves identical and interchangeable.

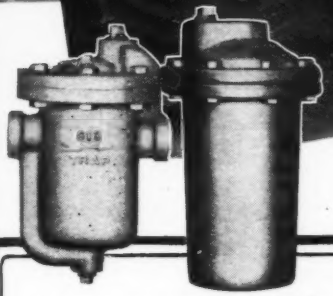
*Reg. U. S. Pat. Off.

NO OTHER COMPRESSOR WILL OUTPERFORM A WORTHINGTON

AC 94

to have hotter Steam Equipment

use ARMSTRONG STEAM TRAPS on Kettles, Retorts, Coils, Presses, Cookers, Tanks, Heaters



• Armstrong Inverted Bucket Steam Traps are built for any pressure and any capacity. Blast Traps for low pressure heating, Standard Traps for general service and Forged Steel Traps for high pressures. No steam leakage. Armstrong Self-Scrubbing action eliminates sticking, binding and clogging of mechanism due to ordinary dirt or scale.

Constructional features include: stainless steel mechanism; chrome steel valve and seat, hardened, ground and lapped; and cast semi-steel of forged steel body. Available in bottom inlet, top outlet and side inlet, side outlet connections.

• Report after report from owners of the more-than-a-million Armstrong Steam Traps in use all over the world, point up the value of Armstrong Traps in keeping steam equipment hotter, reducing heating-up time and saving on maintenance. Here are typical reports by users after installing Armstrong: (Names on request)

Large chemical laboratory in midwest saved $2500 per year in fuel . . . Asbestos firm cut drying time of woven asbestos 50% . . . Chicago plant saved 75% heating-up time and radically increased temperatures . . . Large Pennsylvania firm increased machine temperatures 50% . . . Pittsburgh paper company increased roll temperatures 50% and boosted production . . . Georgia firm raised temperatures and saved 4½ carloads of coal per year . . . Chemical company saved 3,470,000 cu. ft. of gas, or $763.40 per month . . . Large chemical plant saved $25 a day in fuel.

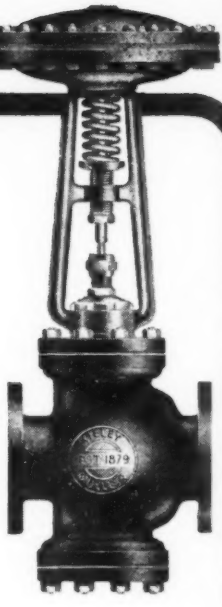
Write for Catalog H, 4th Edition, a complete and valuable book on steam trap selection, maintenance, installation and repair. Prices, capacities, charts, tables and diagrams are also included in this latest Armstrong Catalog. Free on request.

ARMSTRONG MACHINE WORKS
812 Maple Street — Three Rivers, Michigan

ARMSTRONG STEAM TRAPS for **POWER PROCESS HEATING**

HERE IS PROGRESS HERE IS PROOF!

An oldtime NATCO drill press pictured beside a multiple-spindle giant in the Kieley & Mueller plant.



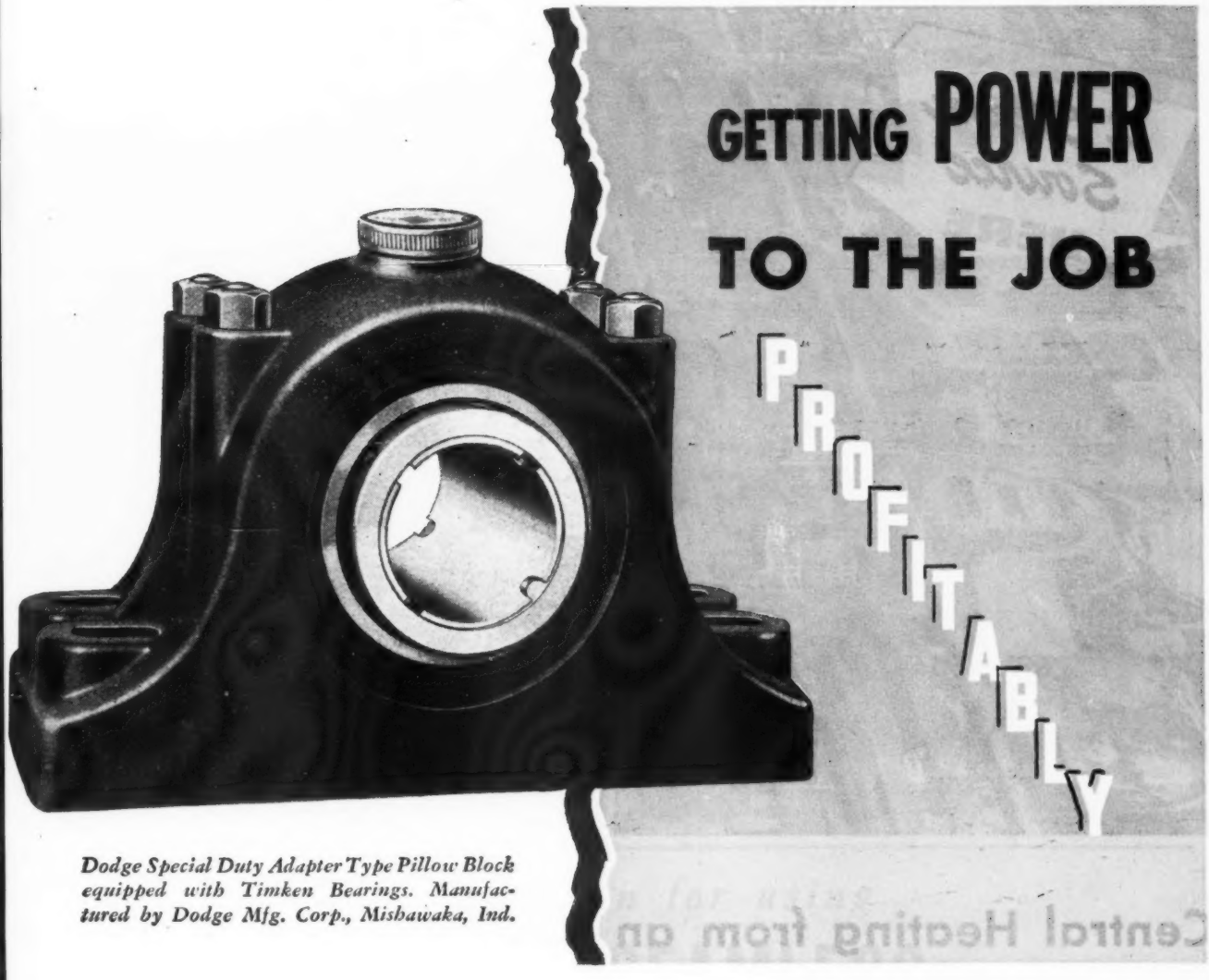
For years the National Automatic Tool Company has made drilling, boring and tapping machines exclusively. Early NATCO Drill Presses did a good job. But the newest ones are enormously better . . . and *we can prove it!* We prove it daily by more accurate machining on Kieley & Mueller Controls. For instance, our Type 422 Pressure Regulating and Reducing Valve. In every detail it's a masterpiece of precision. Use this valve for steam, air, gas, oil or water . . . for closest possible regulation and many years of service. Center guided, self aligning innervalve gives correct alignment and proper seating under varying pressures and loads. Large seat bore area assures minimum pressure drop. Built for initial pressures up to 300 lbs. with reduced pressures from 1 lb. to 75% of inlet, not exceeding 125 lbs.; double or single seated; sizes ½" to 8". Write for complete catalog No. 66. For specific solutions to your control problems, address our Engineering Department.

KIELEY & MUELLER, INC.

MANUFACTURERS OF PRESSURE AND LEVEL CONTROLS SINCE 1879

2001 43rd ST., NORTH BERGEN, N. J.

66 YEARS OF CONTROL PROGRESS



Dodge Special Duty Adapter Type Pillow Block equipped with Timken Bearings. Manufactured by Dodge Mfg. Corp., Mishawaka, Ind.

Power transmission equipment designed to take advantage of Timken Tapered Roller Bearings — like Dodge lineshaft hangers and pillow blocks for example — presents many economies to far-sighted plant managers.

It reduces power consumption; simplifies lubrication and saves lubricant; prevents shaft wear; and greatly curtails involuntary power interruptions.

Another important advantage and one that merits particular mention, springs from the fact that Timken Bearings can be sealed so effectively that leakage of lubricant — and consequent danger of product contamination — is entirely preventable.

Timken Bearing Equipped power transmission units also have a favorable influence on driving belt life by preventing shaft eccentricity — and thereby helping to prevent pulley wobble.

Obsolete transmission equipment is a constant threat to production in many plants; is it in yours? A check-up is indicated. The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

Central Heating from an Available Steam Source Eliminates Individual Boilers and Cuts Fuel Costs

Twenty years ago a group of manufacturers in a compact industrial area made arrangements to purchase and pipe steam from an available source nearby. This made it possible to shut down their own boilers—which, because of smoke regulations, had become antiquated. Also, by dispensing with labor, coal, ash handling and other costs, they effected material savings—in fact, one of the largest users paid for his share of the steam distribution lines out of these savings in 6 months operation.

Today the originally installed steam piping, insulated and protected by Ric-wiL Conduit, is still enabling their plants to enjoy lower steam costs and freedom from individual boiler worries.

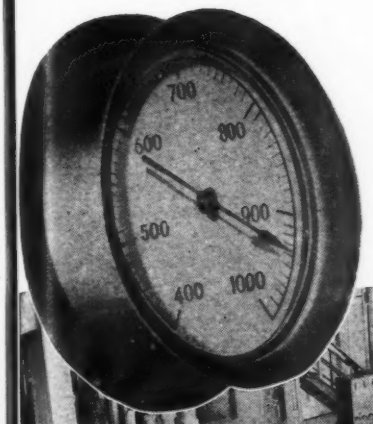
A recent survey by a postwar plan commission indicates the feasibility of increasing the boiler capacity of the same plant to serve an adjacent industrial and residential area comprising five square miles at a substantial profit!

Central Heating is practical for industrial, commercial, institutional and residential groups. Special studies of typical installations are available upon request.

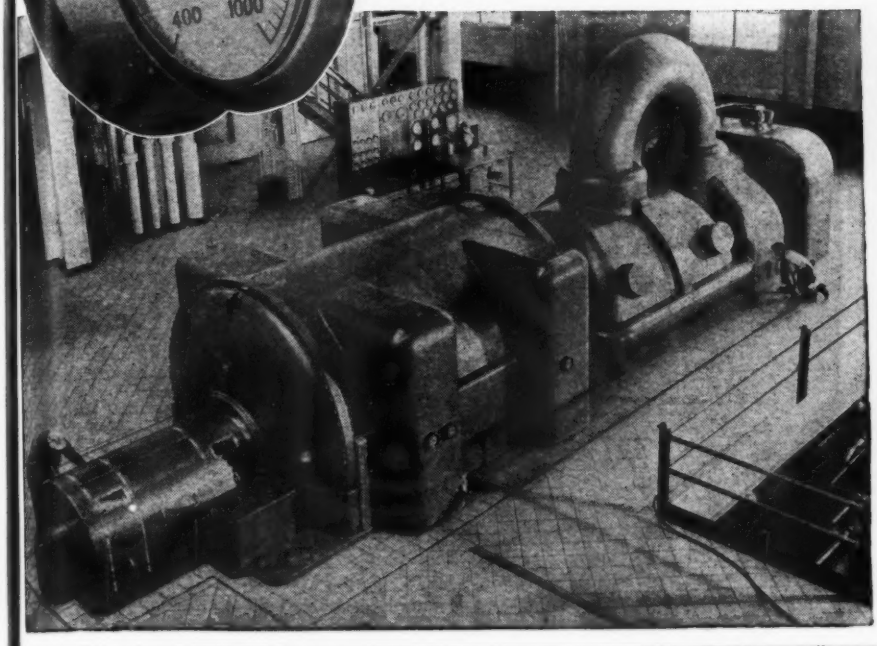
Any Industrial or Residential Area can Enjoy these Advantages

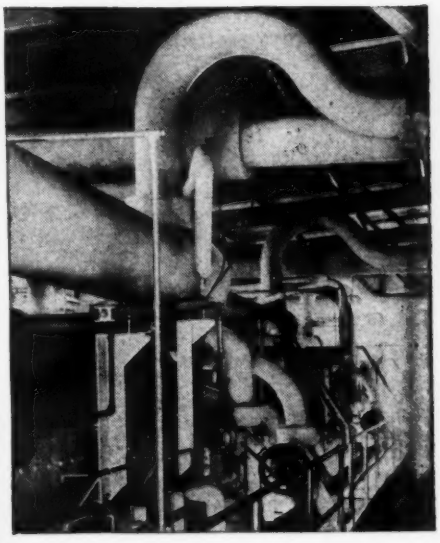
- Savings of 15% or better in fuel costs.
- Elimination of individual boiler worries.
- Cleaner, healthier working conditions.
- Reduction of smoke and soot in neighboring residential areas.
- Extra production space in plants.
- Decreased fire and explosion hazard.
- Private coal delivery and ash removal eliminated.
- Uniform clean heat—whenever required.
- Unfailing source of "process" steam and hot water.

RIC-WIL INSULATED PIPE CONDUIT SYSTEMS
THE RIC-WIL COMPANY · CLEVELAND, OHIO
AGENTS IN PRINCIPAL CITIES



Steam pressures and temperatures are on the UP and UP





HIGH PRESSURE feed water heaters, main steam pipe, heater drains and main feed pipe fabricated from NATIONAL Seamless Pipe.

A vital reason for using

NATIONAL SEAMLESS

WHAT engineers termed high pressures and temperatures ten years ago are low compared with today's practice. And the 2500-pounds pressure and 1000-degrees temperature found in some of today's plants may be considered low by future engineers. It is very much of a relative question, but highly important in its application to boiler tubes and power piping.

Development and manufacture of NATIONAL Seamless Steel Pipe and Tubing to match the progress in boiler plant design, has been in line with NATIONAL Tube Company policy. Our metallurgists and craftsmen have consistently met the increases in steam pressures and temperatures by being able to supply the kind of pipe and tubes wanted. They are fully prepared to cooperate in meeting the future engineering requirements for seamless steel tubular products.

No finer piping has ever been made for power plants than NATIONAL Seamless. In many cases involving severe or hazardous service, the use of seamless pipe is mandatory. "Walls Without Welds" means absolutely seamless—no longitudinal line of potential weakness.

Uniform wall strength has a direct relation to bending, expanding, beading or other working of the pipe—a vital requirement when modern power plants are being built! Use NATIONAL Seamless Pipe for your high temperature, high pressure lines—and NATIONAL boiler tubes, superheater tubes and condenser tubes for your boiler-room equipment—made to Standard A.S.T.M. specifications for high temperature and high pressure service.

WALLS WITHOUT WELDS

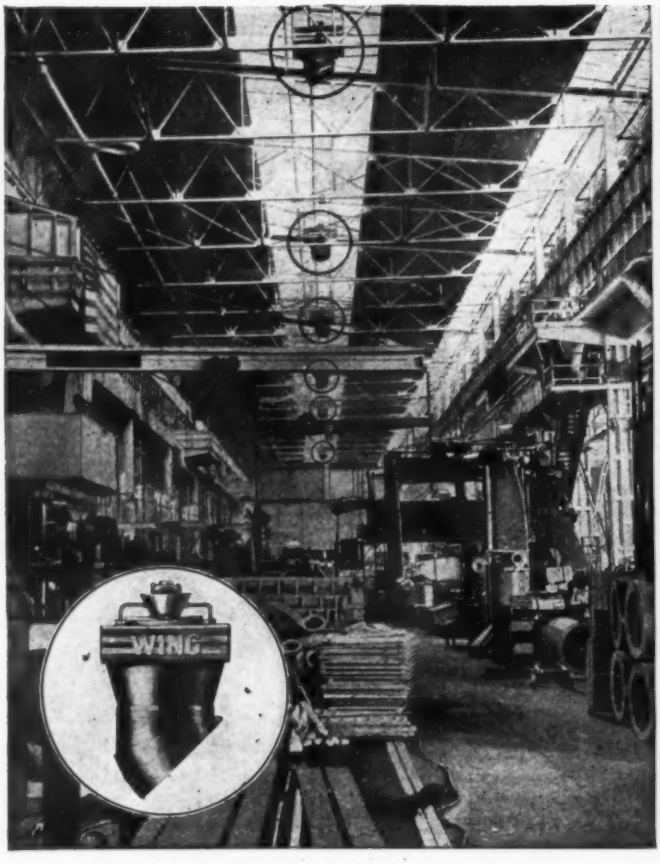
NATIONAL TUBE COMPANY

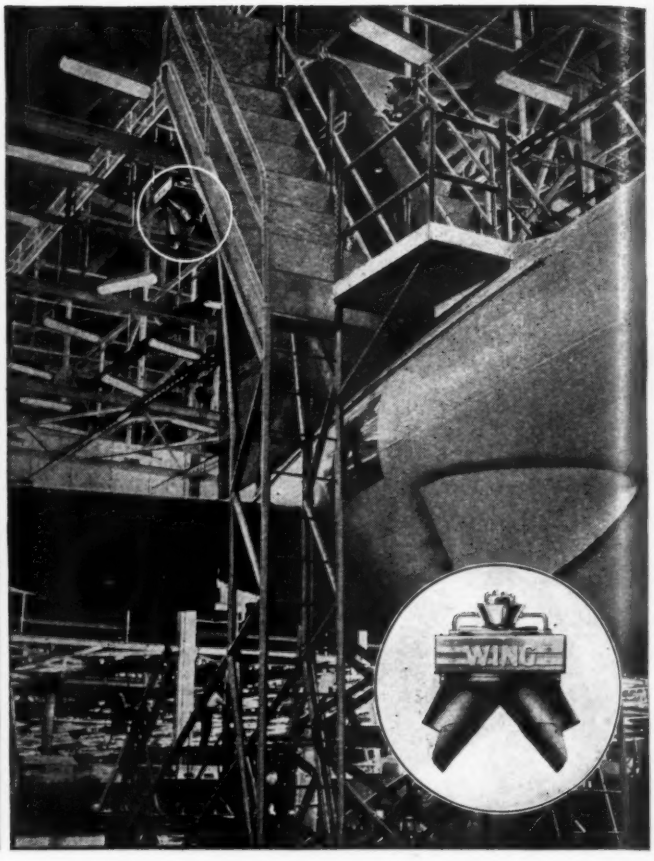
Pittsburgh, Pa.

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Export Company, New York

NATIONAL TUBE COMPANY · USS · STEEL · UNITED STATES STEEL

UNITED STATES STEEL





WING *Revolving* HEATERS

Help Keep Shipbuilders (Sea and Air) on the Job

Two striking instances of the virtues of Wing Revolving Unit Heaters are exemplified in the photographs above.

At the left is one of the shops of a large shipbuilding concern, where the Wing Revolving Heaters are located 61 feet above the shop floor. Yet the heated air is projected down to the working level and circulated by the slowly revolving outlets of the heater so that every part of this huge shop (802 ft. x 156 ft.) is kept warm and comfortable, protecting the health of workers and keeping vital shipbuilding production moving.

At the right is part of the assembly shop of one of the world's largest builders of cargo planes, the future merchant ships of the air. This modern plant is also heated by Wing Revolving Unit Heaters. No other type of heater could so thoroughly and evenly heat a plant of this kind, where the massive planes would form imposing obstacles to the projection of heated air from fixed discharge heaters. But the slowly moving streams of warm air from the revolving discharge outlets of the Wing heaters circulate around and under the huge plane bodies, wings, rudders, stabilizers, etc., and keep the plant at a uniform, comfortable temperature. Employees find that the sensation of warm, live, invigorating comfort is stimulating to production. And in summer, with the steam turned off, and the fans on, an equally pleasant cooling effect may be obtained.

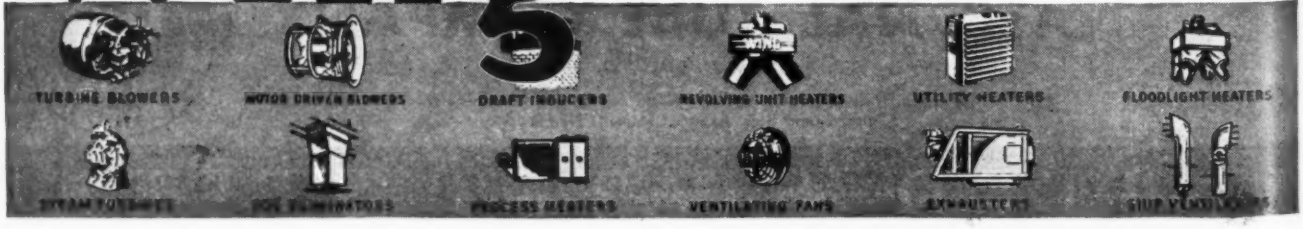
Write for a copy of Wing Bulletin HR-4.

Wing

L. J. Wing Mfg. Co.,

154 W. 14th Street **New York 11, N. Y.**

Factories: Newark, N. J. and Montreal, Canada



HEAT PROVER...QUICKLY REVEALS INCOMPLETE COMBUSTION

FREE Demonstration Test Will Help Solve Your Combustion Problems . . . Conserve Fuel . . . Increase Quantity and Quality of Your Product.

Today, like many engineers in both small and large industrial plants, you very likely want to know—*by accurate measurement*—the answers to these four vital problems:

1. **Just how efficiently do my boilers burn fuel?**
2. **How efficiently do wartime operators control them?**
3. **What have wartime overload conditions done to normal fuel economy?**
4. **And what, actually, is the status of my combustion control equipment?**

To all these questions—and more—Cities Service has the almost perfect answer in the Cities Service INDUSTRIAL HEAT PROVER. This unique instrument quickly analyzes combustion . . . accurately determines degree of fuel waste due to air deficiency or dilution. Thoroughly tested on practically every type of combustion equipment in this country and with every kind of fuel, the Industrial Heat Prover already has been adopted by users of steam power plants, open hearth furnaces, cement kilns, heat-treating apparatus, crucible furnaces and internal combustion engines. And for a very good reason.

Accurate combustion analyses made as a result of the Cities Service Industrial Heat Prover tests have effected considerable savings in fuel costs...reduced repairs and replacements on furnace linings, crucibles and refractories due to flame corrosion... and have led to increased production of better and more uniform products.

Why not get a Cities Service Industrial Heat Prover Test in your own plant? You may have it *without cost or obligation*—if you will simply mail the coupon at right. A Cities Service Engineer will then make an Industrial Heat Prover Test in your plant—at your convenience. Mail the coupon—today.

THE CITIES SERVICE INDUSTRIAL HEAT PROVER—a new, accurate combustion analysis instrument developed by the Cities Service Research Division enables those engaged in the oxygen control of furnace atmospheres to achieve greater combustion efficiency at less cost.

(This offer is available only in Cities Service marketing areas EAST of the Rockies.)

CITIES SERVICE OILS — ONCE-ALWAYS

Cities Service Oil Company
Room 265
Sixty Wall Tower, New York 5, N. Y.

Gentlemen: Please arrange a Cities Service Industrial Heat Prover Test for my plant. I understand there is no charge or obligation for this service.

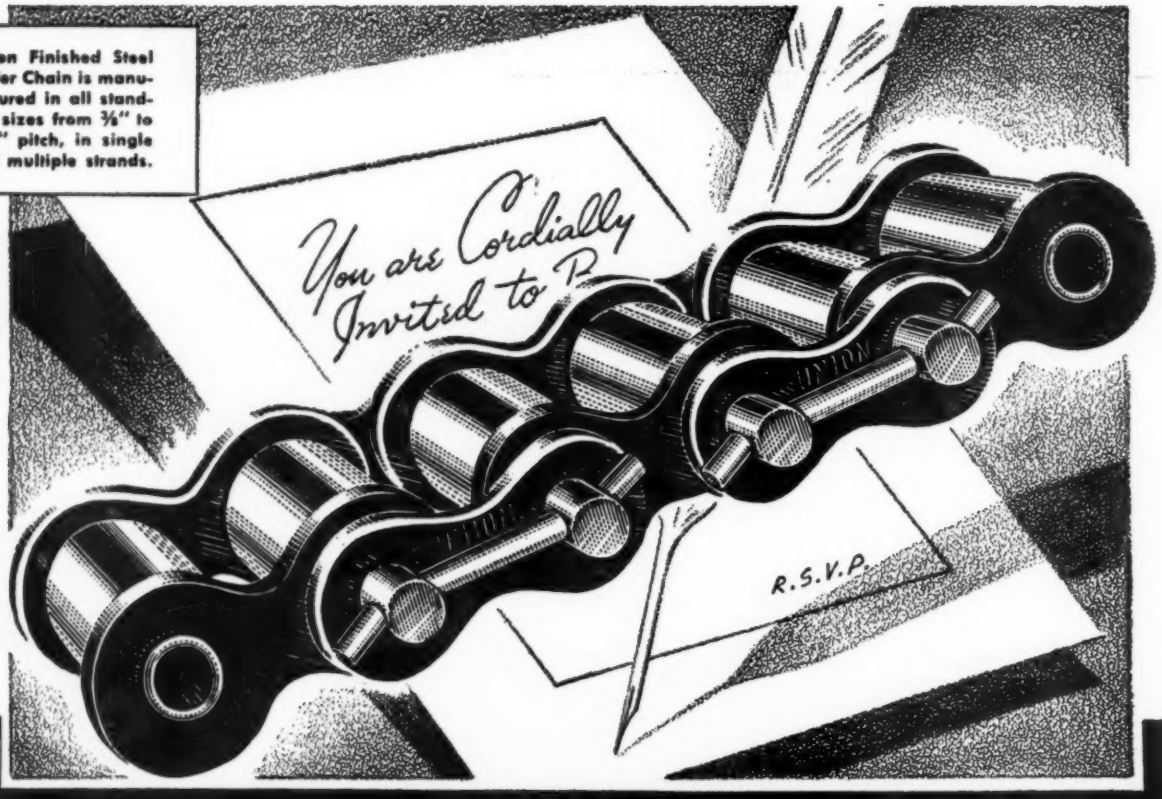
Name.....

Title.....

Company.....

Address.....

Union Finished Steel Roller Chain is manufactured in all standard sizes from ⅜" to 2½" pitch, in single and multiple strands.



INVITATION TO BUY UNION CHAIN

Certainly no one will construe this advertisement as an announcement of idle capacity. What we mean to convey is that we are always pleased to enter orders from new customers providing that we can accept them without the impairment of deliveries on orders already in production. If you buy chain as a necessary part of your own products or as an accessory for the transmission of power or handling materials in your own production, we believe you will be pleased with your choice if you buy Union Chain. Both our chains and our organization have a reputation with customers for "wearing well". Accept our invitation to find out why.

The Union Chain and Manufacturing Company ..... Sandusky, Ohio, U. S. A.

Catalog A-2 covers Drive and Conveying Chain. B-2 covers Finished Steel Roller Chain. FC-1 covers Flexible Couplings. Ask for your copies.

ARMY E NAVY

UNION CHAINS

Union Chains for Every Application

Drive and Conveying Chains and Sprockets

- Bridge Chain
- Combination Malleable Iron and Steel Chain
- HB (hardened bearing) type chain
- BP (bar and pin) type chain

★

Finished Steel Roller Chains and Sprockets

- All manufacturer's standard, size ⅜ in. to 2½ in. pitch
- Single and Multiple Strands
- Extended Pitch Series in sizes 1¼ in. to 4 in. pitch

★

Silent Chain and Sprockets

- All sizes ⅜ in. to 1½ in. pitch

★

Flexible Couplings

- Roller chain type
- Silent chain type

DISCIPLINE

ALONG THE LINE

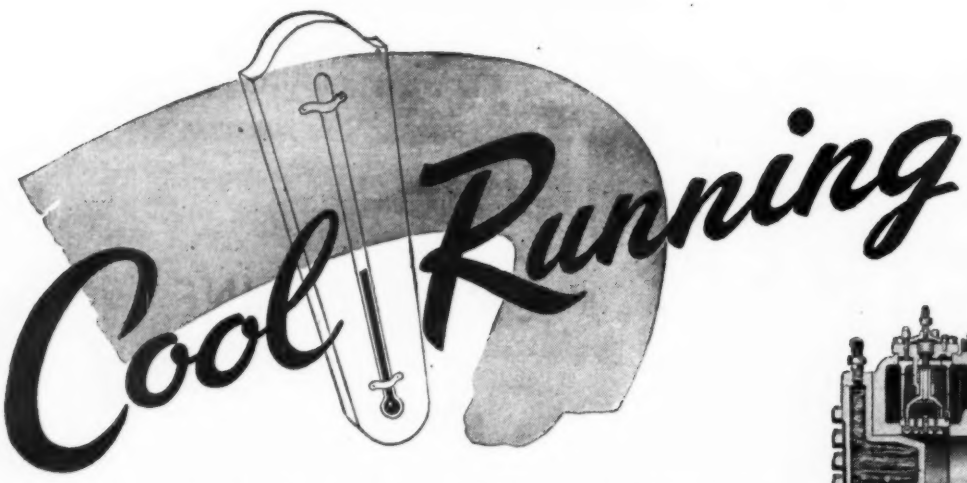
Ring Controlled "PACKLESS" EXPANSION JOINTS

IF YOU were running a single track railroad, you wouldn't let it operate undisciplined and uncontrolled as depicted here. By the same token, a great deal of damage can result in a pipe line unless positive steps are taken to control the forces at work along that line.

Ring Controlled Expansion Joints, as made by the Badger Fire Extinguisher Company, are designed to compensate reliably for any and all pipe line expansion resulting from variations of temperature, pressure, vibrations, or axial movement. Flange or weld types are available with single or multiple corrugations, especially processed to eliminate strain and stress in steam, air, liquid, or gas lines.

Catalog on request

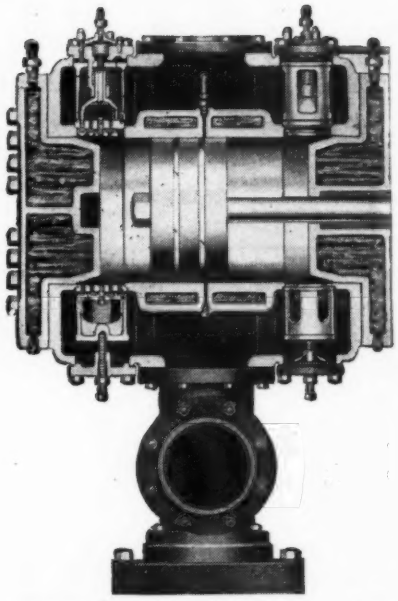
BADGER FIRE EXTINGUISHER COMPANY *Somerville 43, Mass.*



. . . TO REDUCE AIR COSTS!

Horsepower savings . . . lubrication economy . . . less wear and tear on air hoses and air tools . . . all these advantages are yours with the *cool-running* Gardner-Denver "RX" compressor.

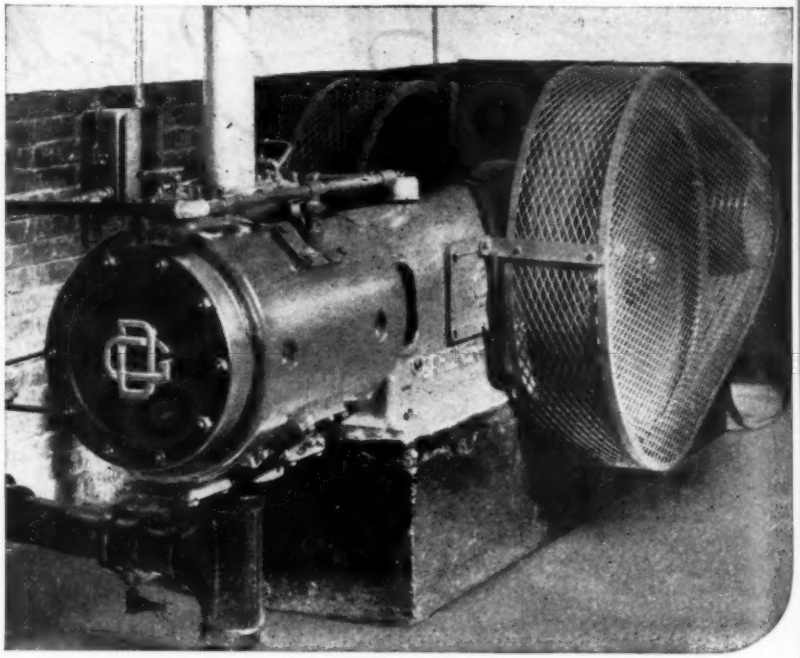
Complete jacketing of all valves, air passages and cylinder heads plus large and unrestricted valve and port areas of this Single-Stage Horizontal Compressor reduce the heat of compression, insure minimum oil consumption and increase compression efficiency.



Cross-section of cylinder showing jacketing and large port areas.

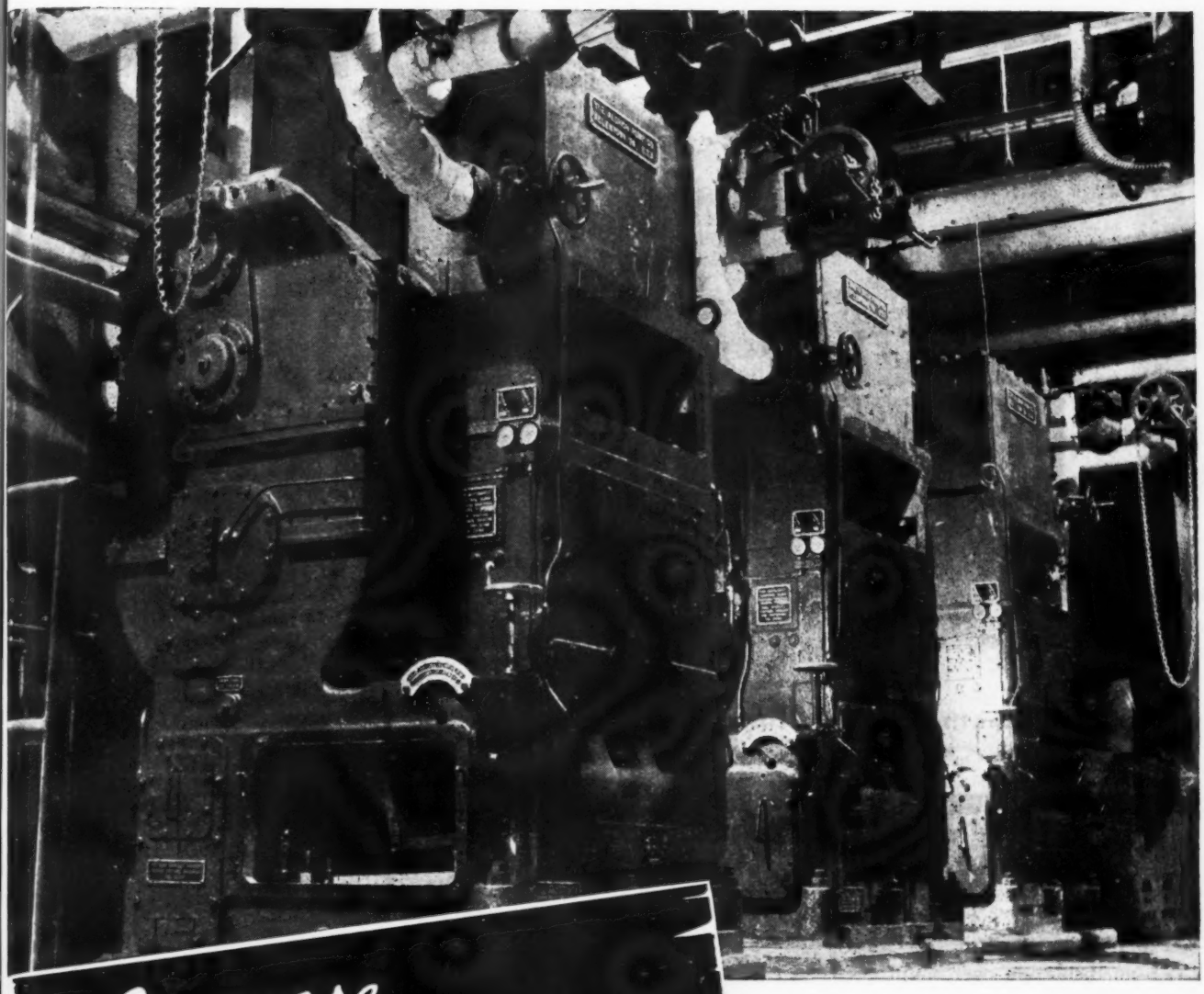
OTHER "RX" ADVANTAGES

1. **Additional horsepower savings because air is automatically regulated to fit your needs.**
2. **Rugged dirt-free main frame assures long life . . . minimum maintenance.**
3. **Positive flood-type lubrication assures ample lubrication of all moving parts.**
4. **Duo-Plate "cushioned" valves are simple, durable, and quiet in operation.**
5. **Smooth, vibration-free operation assured by counterweighted crankshaft and Timken tapered roller bearings.**



For complete information on Gardner-Denver "RX" Single-Stage Horizontal Compressors, write Gardner-Denver Company, Quincy, Illinois.

GARDNER-DENVER *Since 1859*



Increase POWER PLANT EFFICIENCY with

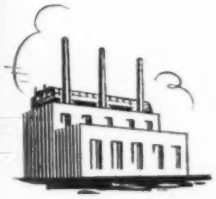
...ALDRICH-GROFF CONTROLLABLE CAPACITY "POWR-SAVR" PUMPS

Aldrich-Groff pumps on unit feed systems eliminate pressure and power losses common to throttling-type feed regulating valves and offer advantages of feed system simplicity, efficiency and mechanical reliability for small and medium installations at medium and high steam pressures.

Equally important overall power savings are effected by Aldrich-Groff pumps on de-superheater feed service in connection with high pressure topping units for power stations of any size.

The three Aldrich-Groff 3¼" x 0 to 6" variable stroke vertical triplex pumps shown above are in service in a mid-western central station employing the unit system for main boiler feed. Two are driven by constant speed motors and the third by a constant speed steam turbine. Power consumption is almost directly proportional to pump delivery.

The 6" stroke—3¼" plunger pump is a 100 HP unit and when operating at maximum speed can deliver 70,000 pounds of feed water per hour against 1025 pounds boiler pressure.



WRITE TODAY...

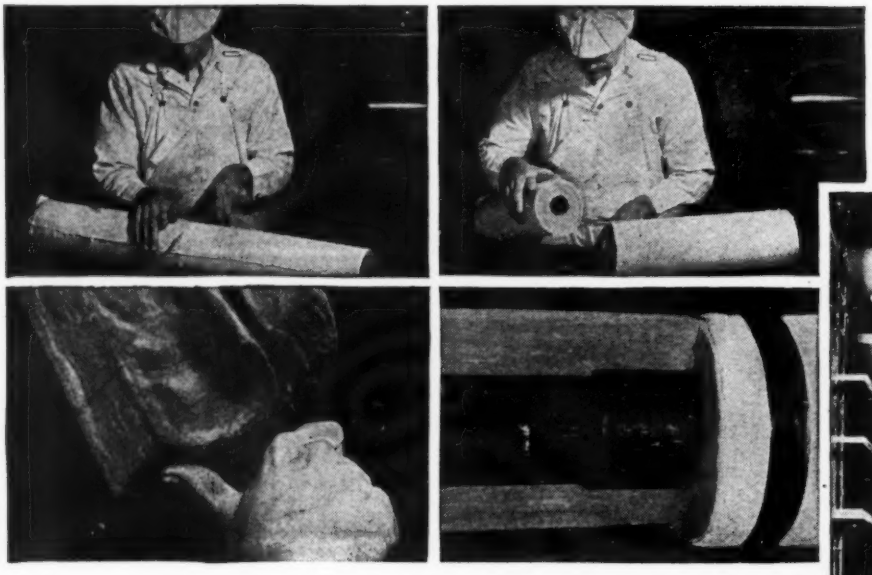
for bulletins and material giving full details, sizes and ratings of Aldrich-Groff Pumps.

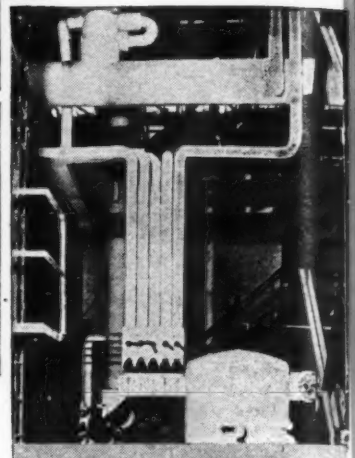
THE ALDRICH PUMP CO.

3 GORDON STREET
ALLENTOWN • PENNA.

REPRESENTATIVES: Birmingham • Bolivar, N. Y. • Boston • Chicago • Cincinnati • Cleveland • Denver • Detroit • Duluth • Houston • Los Angeles • Pittsburgh • Portland, Ore. • St. Louis • San Francisco • Seattle • Tulsa

★ easier-faster application





PF (Pre-formed) PIPE INSULATION

. . . another reason for using

FIBERGLAS*

Cut it and trim it and fit it to size—installing Fiberglas PF Pipe Insulation over couplings is as easy as that.

Made in three-ft. sections, lightweight PF is easy to handle. It can be cut with an ordinary knife to form a snug fit with minimum loss of insulation thickness and efficiency. Couplings are invisible when work is finished. The fibrous ends of the sections intermesh to form tight joints.

In co-operation with the Government program to save critical fuel.

Fiberglas PF Pipe Insulation is made of fine glass fibers bonded with a thermosetting binder and molded into standard sections and segments. It is used for steam and other hot lines up to 30″ O.D. with temperatures up to 600° F.

The unusually low thermal conductivity of PF results in significant savings in heat and power. Fiberglas does not rot or decay, disintegrate or pack down under vibration. And because of its mechanical strength, this pipe covering holds its shape, withstands handling and is easily applied even on the larger pipes where three segments are used.

For complete information about Fiberglas Pipe Insulations and the many other uses of Fiberglas, write for the booklet "Fiberglas Insulations for Industry," *Owens-Corning Fiberglas Corporation, 2000 Nicholas Building, Toledo 1, Ohio. In Canada, Fiberglas Canada Ltd., Oshawa, Ontario.*

FIBERGLAS INDUSTRIAL INSULATIONS

1. Blanket Type Pipe Insulation—With mesh wire on outer side to wrap around pipe and secure with wire through special edging. Manufactured in 2-ft. sections for pipes over 3″ O.D. Will withstand temperatures up to 1000° F.

2. Metal Mesh Blankets—With mesh wire or expanded metal on one or both sides. Lightweight and easily applied. 2 ft. x 4 ft. and 2 ft. x 8 ft. In standard thicknesses. Two types: For temperatures up to 600° F. and 1000° F.

3. No. 600 PF Block—Same materials as in PF Pipe Covering — in blocks 6″ x 36″ and 12″ x 36″, standard thicknesses.

4. OC-1800 High Temperature Block—A highly efficient molded block in sizes 3″ x 18″ and 6″ x 36″ and 12″ x 36″—in standard thicknesses. Will withstand surface temperatures up to 1800° F.

5. Insulating Cement—For insulating fittings, valves and all irregular surfaces. Highly efficient . . . withstands temperatures up to 1200° Fahrenheit.

6. OC Mastic Finish—An asphalt emulsion cement for insulated pipe and equipment exposed to outdoor or high moisture conditions.

7. Insulating Wool, Type TW-F—Available in bats, rolls and bulk. Used for drying-ovens, heaters, etc., for filling irregular spaces.

8. PF Insulation—Manufactured in 5 densities from 2½ to 9 lbs. per cu. ft.—standard sizes 24″ x 48″, 1″ to 4″ in thickness, according to density. For insulated panels, sound absorption and various semi-structural applications.

9. PF Roof Deck Insulation—9 lbs. density with facing to facilitate mopping. Highly efficient, with incombustible, rotproof and moisture-resistant core, for application under industrial built-up roofings. Sizes 24″ x 48″. Thicknesses from 1½″ to 2″.

ARMY E NAVY

FIBERGLAS

*Trade Mark Reg. U. S. Pat. Off.

INDUSTRIAL INSULATIONS

DEXTER HELPS SOLVE MY UPKEEP PROBLEM

. . . Says the Maintenance Director

It makes a crew job a one-man job!

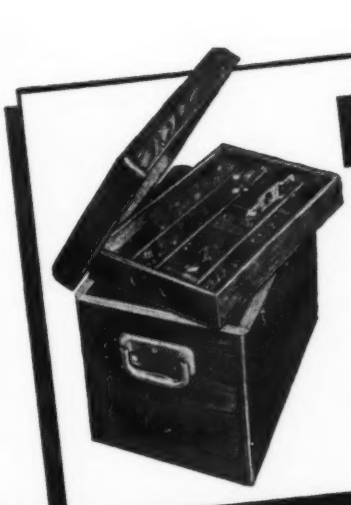
It's tough keeping down maintenance costs these days — and every unnecessary job eliminated means a better record for my department. The Dexter Valve Reseating Machine has eliminated the expense of a crew that formerly had to spend hours repairing or replacing leaky valves in the plant. Now — one man reseats the valve, skillfully, effectively, *right on the line*, in a few minutes.

And, of course, many more production hours are saved by eliminating long shutdowns while valves are replaced. No more morale-breaking layoffs either.

Our engineers are Dexter boosters, naturally, Dexters stop those big valve-leak losses in air, steam and water — and the reseated valves actually perform better than new ones.

* * *

A large part of our production facilities is devoted to war work. Orders for Dexter Machines and Cutters, from firms who want this economy and efficiency, have far exceeded our non-military manufacturing facilities. Please be patient — we will deliver just as quickly as possible.



DEXTER VALVE RESEATING MACHINES AND CUTTERS

for Globe, Gate and Pump Valves

Write Today . . .

for information on the Dexter Reseating Outfit to keep your valves in shape. Give make, type, size and material — whether steam, air or water. No obligation.

22

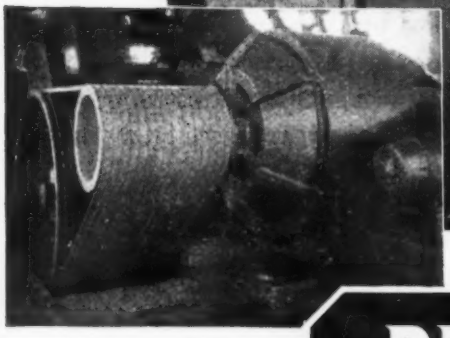
THE LEAVITT MACHINE COMPANY
ORANGE, MASSACHUSETTS

Champion Endless Cord Construction

■■■ **ASSURES MATCHABILITY AND MULTIPLE EFFICIENCY**

Designed with high-tensile, pre-stretched, continuous cords imbedded in rubber, Republic's Champion Multiple-V Belts have the ability to handle peak loads without stretching and yet retain elasticity and flexibility . . . . . .

Republic also offers Champion V-Belts on special order for special services: Static Control V-Belts for elimination of sparking hazards, Reprene Cord V-Belts for resistance to oil and heat, and Champion Steel Cable V-Belts for extremely heavy duty service. Consult your nearby Republic Distributor on your requirements.



WE ARE PARTICIPANTS IN THE OWNERSHIP AND OPERATION OF NATIONAL SYNTHETIC RUBBER CORPORATION

BETTER THAN BEFORE

REPUBLIC RUBBER

DIVISION

LEE RUBBER & TIRE CORPORATION

YOUNGSTOWN 1, OHIO

REPUBLIC INDUSTRIAL PRODUCTS
YOUNGSTOWN, O.

LEE DELUXE TIRES AND TUBES
CONSHOHOCKEN, PA.

Announcing—

the SECOND U. S.-made "Megger" Instrument ... THE MIDGET "MEGGER"* INSULATION TESTER

Following the production, in June 1943, of the first U. S.-made "Megger" testers, we now announce a second "Megger" instrument being built in our Philadelphia factory—the Midget "Megger" Insulation Tester.

This new U. S. model is identical in design and similar in every way to the Midget "Megger" Insulation Testers we have been supplying for the past ten years, except that the molded plastic housing is mottled brown instead of red.

The Midget "Megger" Tester has achieved wide popularity because of its size and low cost. Weighing but 3 pounds, it is always ready to use for testing insulation resistance of a wide variety of electrical equipment. It is indispensable for maintenance and trouble shooting, even where higher range "Megger" testers can be used . . . reads up to 50 megohms and delivers 500 volts d-c from a hand-cranked generator, making it independent of batteries or external power supply. Lower ratings are also available.

Manufacturing facilities are complete and our expanding production makes availability of these new instruments far better than we have previously been able to offer. We invite your orders for them.

JAMES G. BIDDLE CO.

1211-13 ARCH STREET • PHILADELPHIA 7, PA.

For complete description of the new U. S.-made Midget "Megger" Tester, write for Bulletin 1785-P.

**By special arrangement with the original makers of the "Megger" Testing Sets, our new instrument carries the U. S. Registered Trade Mark "MEGGER."*

WALWORTH

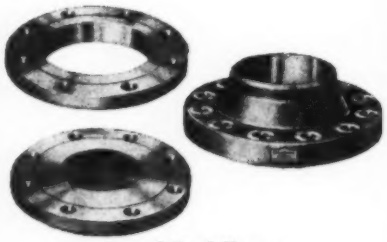
Pipe Fittings

A complete line of standardized types in

STEEL
in series 150 to 1500

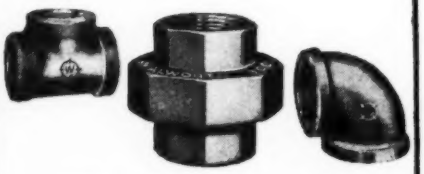
Cast Steel Fittings

Steel Welding Fittings



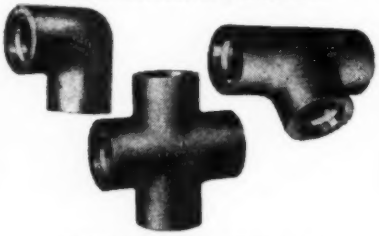
Forged Steel Flanges

BRONZE



125 Lb and 250 Lb, Screwed ends

150 Lb and 300 Lb Walseal ends

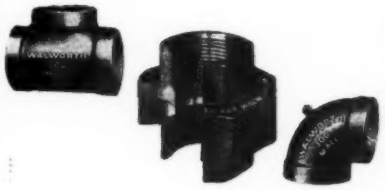


3,000 Lb O.W.G., Walseal ends

IRON

125 Lb and 250 Lb Cast Iron

150 Lb Malleable Iron



300 Lb Malleable Iron

Walworth's comprehensive line of pipe fittings is made in a wide range of types and sizes to meet every piping requirement. A few of the many regular Walworth fittings are illustrated above. All Walworth fittings are made to the highest standards of quality, both as to dimensional accuracy and metallurgical properties. In design, construction, and performance, they reflect Walworth's 103 years' experience in the manufacture of quality valves and fittings.

For detailed information on Walworth's complete line of valves, fittings, and pipe wrenches, see your local Walworth distributor or write for a free copy of Catalog 42.

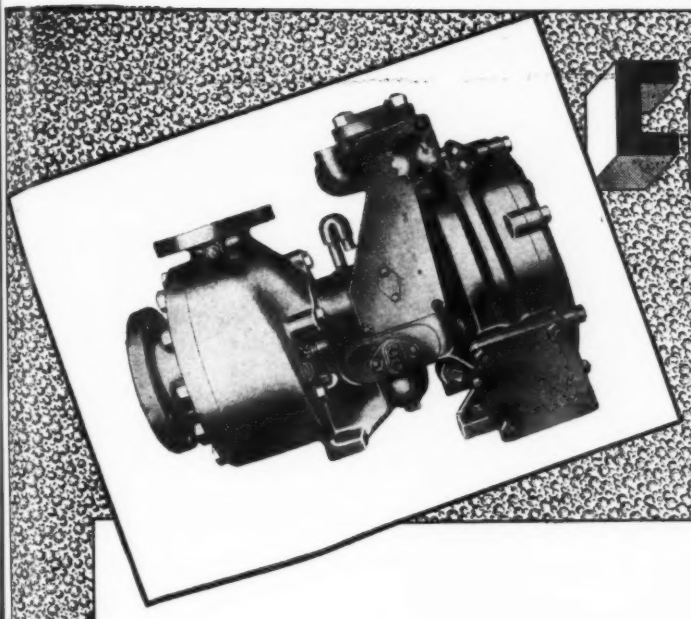
12 AWARDS
TO 4 PLANTS

WALWORTH
valves AND fittings
60 EAST 42nd ST., NEW YORK 17, N. Y.

LABORATORY CONTROL

To assure strict adherence to specifications, sample test bars of the metals from which Walworth Pipe Fittings are made are subjected to regular testing in Walworth laboratories. These and other regular controls and inspections assure the high quality of all Walworth Pipe Fittings. The illustration shows a test on a cast iron transverse bar.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD



COFFIN TURBO PUMPS

Portrait Of A Salesman

When a Coffin Turbo Pump first arrives for installation the engineer is often skeptical of its ability due to its size and weight.

When it is placed on the line, its smooth, quiet operation and performance quickly change skepticism to praise.

Our star demonstration salesman, the Coffin Turbo Pump, has sold another prospect. It will sell you!

DELIVERIES TO 350 G.P.M.
PRESSURES TO 500 P. S. I.

Saves Space, Weight and Steam

THE J. S. COFFIN, JR., CO
ENGLEWOOD, N. J.

Mail the Coupon

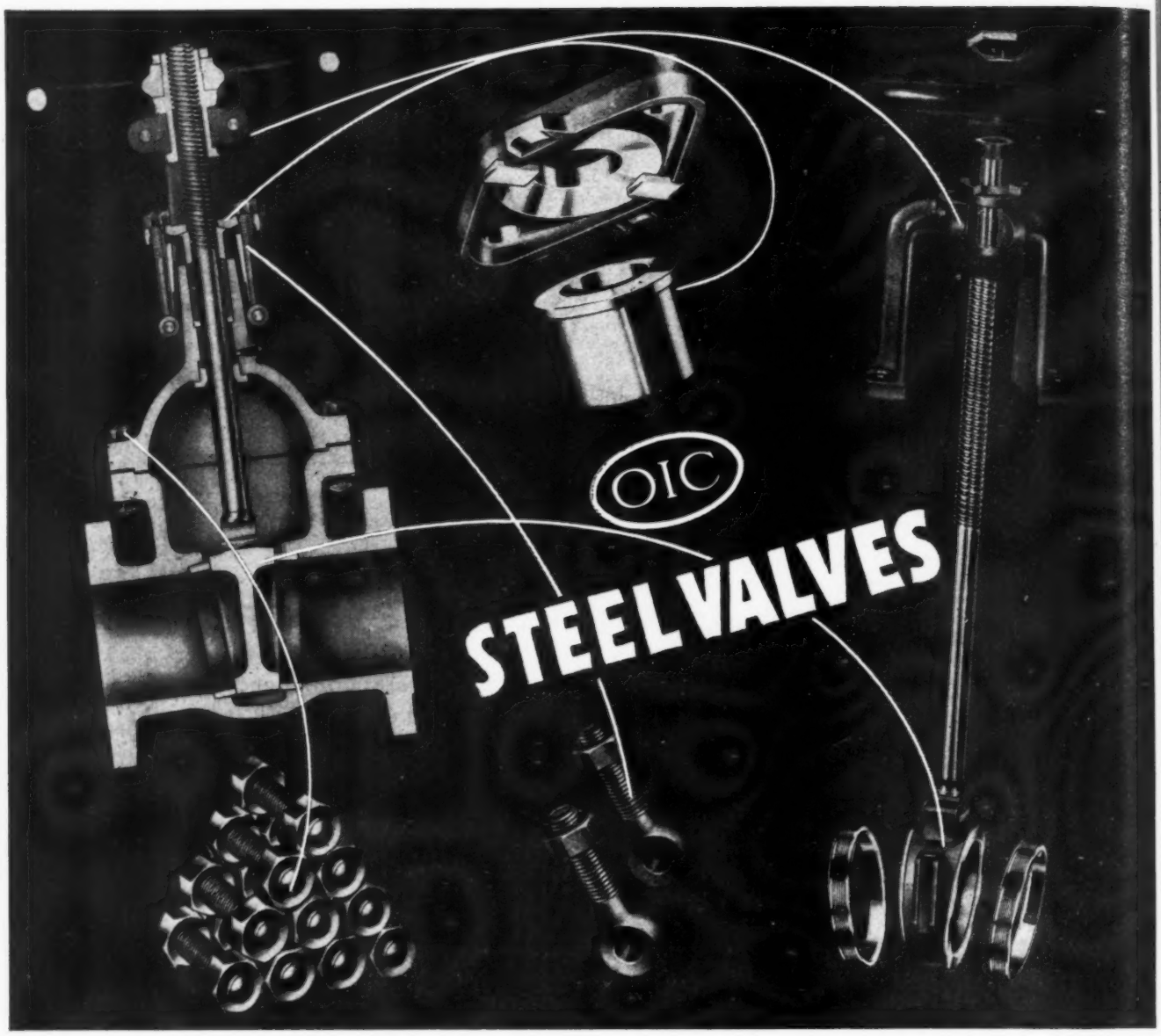
PLEASE SEND DESCRIPTIVE BULLETIN

NAME _____

COMPANY _____

ADDRESS _____

P. W.



MATCHING the superior qualities of OIC Bronze and Iron Valves that have been outstanding for more than 60 years, OIC Cast Steel Valves are in pace with today's emergency demands . . . filling a definite need wherever steel valves are required.

Combining time-proved features with tested modern refinements, they equal and exceed the quality and performance standards set by the principal users' and manufacturers' specifications.

OIC Cast Steel O.S. & Y. Gate Valves are built to control fluid flow dependably and absolutely. They are contributing vitally to the efficient operation of:

Petroleum Refineries
Oil & Gas Pipe Lines
Central Power Generating Plants
Industrial Power Units
General Industrial Processes

OIC Steel Gate Valves* are regularly available in trims suitable for oil, oil vapor, steam, water, gas or air service over a broad range of pressures and temperatures. Valves with trims for other services available on special order.

There is an OIC Distributor near you, ready to demonstrate to you the many superior features of OIC Cast Steel Valves. Call him . . . or write to us for details.

***Also available are companion OIC Steel Globe, Angle and Swing Check Valves.**

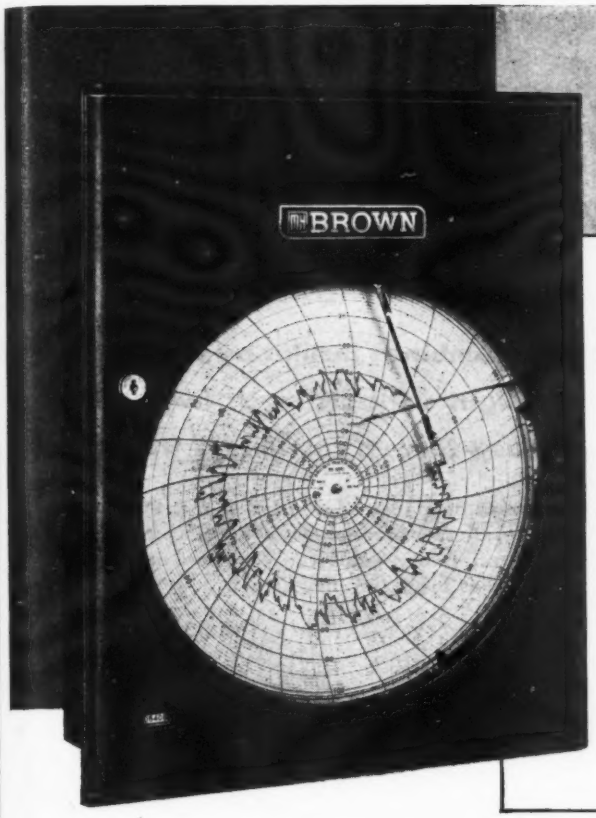
ARMY E NAVY

OIC

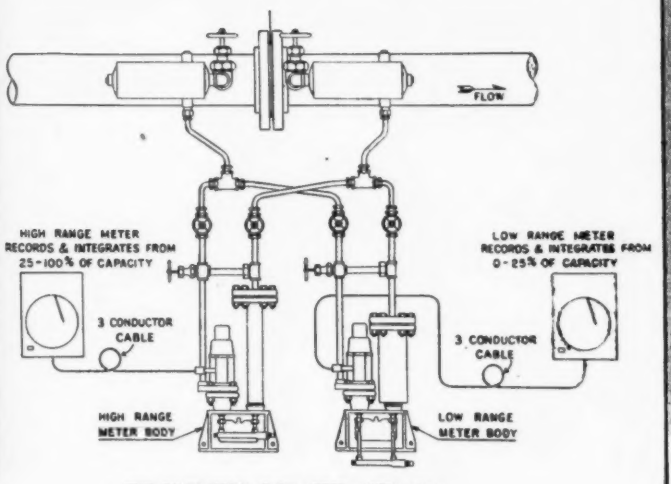
THE OHIO INJECTOR COMPANY

WADSWORTH, OHIO

Quality Leaders in Valve Manufacture Since 1883



Ideal for WIDE RANGE FLOW


FLOW
HIGH RANGE METER RECORDS & INTEGRATES FROM 25-100% OF CAPACITY
LOW RANGE METER RECORDS & INTEGRATES FROM 0-25% OF CAPACITY
3 CONDUCTOR CABLE
3 CONDUCTOR CABLE
HIGH RANGE METER BODY
LOW RANGE METER BODY

WIDE RANGE STEAM FLOW METER INSTALLATION

Operating Advantages

1. **Operates on the Inductance Bridge Principle! Inherently independent of voltage changes.**

2. **AUTOMATIC PLANIMETER PEN gives you a record on total flows over any period of time.**

3. **SIX INTERCHANGEABLE RANGE TUBES assure quick adjustment to changes in operating conditions.**

4. **INTEGRATOR DIAL. Easy to read. Simple counter—plain figures. Read it like your automobile mileage indicator.**

FOR metering steam where the flow varies over extremely wide ranges, the Brown Flow Meter System, shown above, fulfills every requirement for high pressure steam heating and process loads.

The system consists of two meters connected to the same orifice. The low range meter records and integrates the flow from 0 to 25 per cent of maximum.

The high range meter records and integrates flows from 25 per cent to 100 per cent of maximum. The sum of both integrator readings gives the total steam flow. The change from one meter to the other is automatic and requires no manual operation.

Either or both meters can be supplied with auxiliary indicating scales and can be equipped with air control features in case it is desired to limit the maximum flow.

Brown Flow Meters are a guarantee of satisfaction to both the user and producer—for example, in the city of Washington, D. C., there are more than thirty stations where steam is measured by this practical method.

The Brown Wide Range Meter System is easily installed in large and small central distribution plants where accurate accounting is a requisite.

Write for Catalog 2008. THE BROWN INSTRUMENT COMPANY, *a division of Minneapolis-Honeywell Regulator Co.*, 4490 Wayne Ave., Philadelphia 44, Pa. Offices in all principal cities. Toronto, Canada; 119 Peter Street—England; Wadsworth Road, Perival, Middlesex—Sweden; Nybrokajen 7, Stockholm.

BROWN FLOW METERS
. . . MINNEAPOLIS-HONEYWELL CONTROL SYSTEMS . . .

the most AMAZING Castable Refractory in Engineering History!

NEW! Nothing Like Kast-O-Lite

INSULATION FOR USE TO 2500° F. IN DIRECT CONTACT WITH FLAME

There is no other castable like Kast-O-Lite. It's INSULATION plus CASTABLE for use in direct contact with flame to 2500°F. **DON'T CONFUSE THIS NEW ACHIEVEMENT IN INSULATING CASTABLE REFRACTORIES WITH GENERALLY OBTAINED CASTABLES FOR USE TO ONLY 1800° TO 2200°F.** Kast-O-Lite has a fireclay base—a high P. C. E.—and like no other insulating castable, will withstand continued direct exposure to furnace gases to 2500°F.

KAST-O-LITE combines insulating properties and light weight with strength in one dependable, easy-to-use, castable refractory.

Now, for dozens of industrial and boiler furnace uses, you can have all the advantages of an efficient, reliable castable refractory—plus the economy and heat saving benefits of insulating firebrick.

All of these properties are combined in KAST-O-LITE, the most amazing refractory material in engineering history. Used in actual service in every type of installation where an insulating castable is desirable and imposing every possible test — KAST-O-LITE has exceeded every operating requirement.

Wide Range of Uses

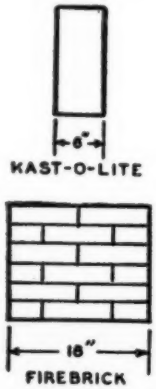
Because KAST-O-LITE is not only a castable—or just an insulation—but a dependable combination of both—it offers a wide range of uses. Wherever insulating refractory properties are desired, KAST-O-LITE offers construction advantages and economy. For complete linings, walls, arches or special shapes.

Easy to Use

KAST-O-LITE, as its name implies, may be cast into place using simple formwork in much the same manner as structural concrete. Mix with water and puddle or pour. Furnace walls, arches, linings or back-up are placed in monolithic sections. Shapes can be made easily and quickly.

Cuts Fuel Bills!

SAVES—REDUCES HEAT LOSSES



The light weight and composition of KAST-O-LITE means that less heat is lost through the lining. Thermal conductivity as used is only approximately 30% that of heavy firebrick. This denotes only 6" of KAST-O-LITE is equal to 18" of firebrick in insulating value. Closer temperature control is possible. Fuel savings result.

And because KAST-O-LITE weighs only 78 lbs. per cubic foot the weight of the lining can be reduced approximately 50% as compared with heavy firebrick.

Quick Delivery— Local Stocks & Service

Warehouse stocks of KAST-O-LITE are located near you for prompt delivery. Look in the classified section of your local telephone directory for the name of your nearest A. P. Green representative. He'll be glad to show you more about the advantages of KAST-O-LITE.

U. S. MARITIME "M" FOR PRODUCTION ACHIEVEMENT

A. P. GREEN FIREBRICK COMPANY

A. P. GREEN — *the First Name in Refractories*

MEXICO, MISSOURI

KAST-O-LITE

INSULATING CASTABLE REFRACTORY

MODERN DEVELOPMENTS OF GASKET RESEARCH

V-TITE...

A BETTER JOINT SEAL FOR HIGH PRESSURE LINES

All Industry may benefit from the Petroleum Industry's solution to one of the most difficult gasketing problems.

The Ring-Type Joint, providing an all-solid-metal joint assembly, is fast finding favor in high pressure and temperature steam and chemical processing services.

Goetze V-Tite Gaskets, used almost exclusively by the Petroleum Industry for sealing ring-type joints, are the product of years of mechanical, metallurgical and chemical research.

They are available in Armco Ingot Iron or low carbon steel, 4-6 Chrome Alloy Steel, or any of the several other desirable metals or alloys; in sizes ranging from one to 80 inches in diameter and of standard oval or octagonal shape.

Every step in the fabrication of V-Tite Gaskets, from metal analysis to final inspection, is rigidly controlled to guarantee strict adherence to every detail of specifications. Extremely close tolerances are maintained to secure perfect fit.

Brinell hardness of 80-90 for Armco Ingot Iron and below 130 for 4-6 Chrome Alloy Steel, is carefully maintained by heat-treating. This assures proper flow of gasket material without damage to flange surfaces and undue stress on bolting.

Consider this better sealing method for your post-war plant requirements.

For other gasket data, interesting to engineers, write for a series of technical bulletins, based on original gasket research from the Goetze Laboratory. Please use company letterhead and mention position.

GOETZE GASKET & PACKING CO., INC.
10 ALLEN AVENUE, NEW BRUNSWICK, NEW JERSEY

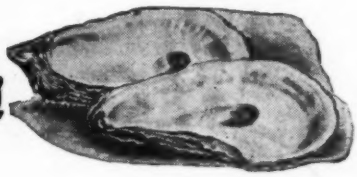
LOWELL THOMAS Speaks on New Gasket Film

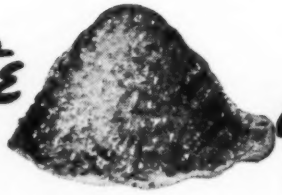
Now available to employee groups, technical societies, engineering schools and other organizations throughout the country, this new 35-minute Kodachrome film, "Only a Gasket," tells why these are the "Biggest little things" in modern Industry. Write for full information.

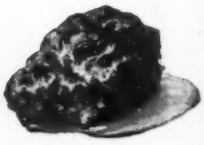
Goetze for GASKETS

"America's Oldest and Largest Industrial Gasket Manufacturer"

The Case of the Oyster Shells the Dolomite and the Coke







It is bad enough to have one difficult materials handling problem. But when you have three, then it really becomes serious. That is the fix in which a certain chemical company found itself.

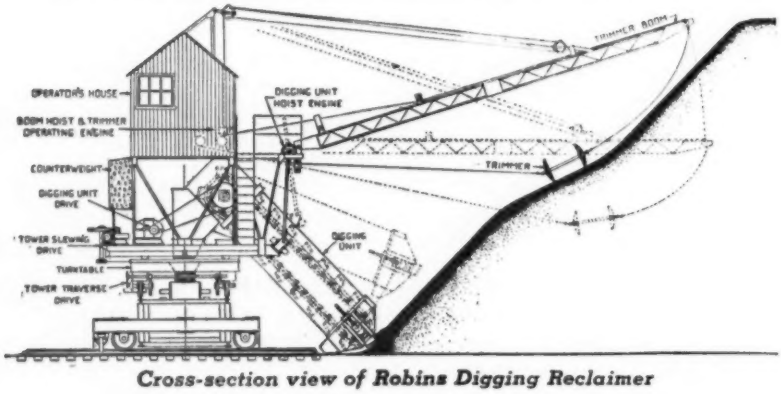
There were oyster shells and dolomite and coke—all to be unloaded, stocked in storage piles and reclaimed for use. The oyster shells tended to arch and pack; the dolomite was crystalline in form; the coke was frangible and friable. Each presented its own peculiar difficulties in handling, yet all would have to be handled on the same unified system.

The problem was put up to Robins. Some parts of it were easy—the unloading, storing and conveying; the answers were drawn from our long and varied experience. But the reclaiming was something else again. Because the oyster shells tended to arch and pack, because the coke was so easily broken, traditional reclaiming methods were not adequate; the shells would not flow and the coke would break.

Nothing in existence up to then was able to do the job properly. So Robins engineers had to invent something. We call it a "Digging Reclaimer." It under-mines the material—working along the bottom of the pile instead of the top. It reduces degradation and breakage to an absolute minimum. It reduces the cost per ton of material reclaimed to a figure never before reached.

Thus another difficult problem was solved. Thus another innovation was added to an already imposing list of Robins "firsts." Thus another company was able to obtain celerity, efficiency and economy in the handling of its materials.

Solving difficult bulk-materials handling problems has been a Robins habit since 1896. Perhaps you face one now. If so, you are invited to submit the facts to Robins for unbiased, non-obligating analysis. When writing, please address Dept. P-4.



Cross-section view of Robins Digging Reclaimer

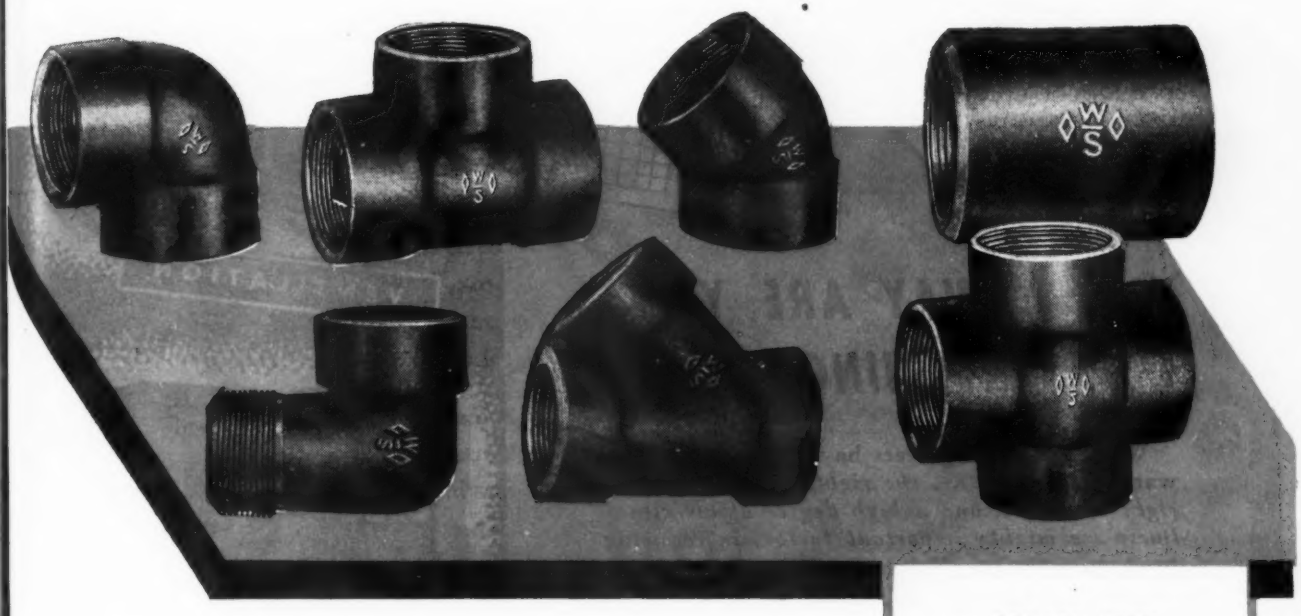
ENGINEERS, MANUFACTURERS AND ERECTORS OF MATERIALS HANDLING MACHINERY

ROBINS *makes:* BELT CONVEYORS · COAL AND ORE BRIDGES · BUCKET ELEVATORS · CAR AND BARGE HAULS · CAR DUMPERS · CAR RETARDERS · CASTINGS · CHUTES · CONVEYOR IDLERS AND PULLEYS · CRUSHERS · FEEDERS · FOUNDRY SHAKEOUTS · GATES · GEARS · GRAB BUCKETS · PIVOTED BUCKET CONVEYORS · VIBRATING SCREENS · SCREEN CLOTH · SELF-UNLOADING BOAT MECHANISMS · SKIP HOISTS · STORAGE AND RECLAIMING MACHINES AND SYSTEMS · TAKEUPS · LOADING AND UNLOADING TOWERS · TRIPPERS · WEIGH LARRIES · WINCHES · WINDLASSES

FOR MATERIAL AID IN MATERIALS HANDLING . . . . . It's **ROBINS**

ROBINS
CONVEYORS
INCORPORATED
Founded in 1896 as Robins Conveying Belt Co.
PASSAIC • NEW JERSEY

"PERFORMANCE-PROVED" QUALITY IN W-S FORGED STEEL PIPE FITTINGS MEANS EXTRA STRENGTH . . . SAFETY . . . SERVICE



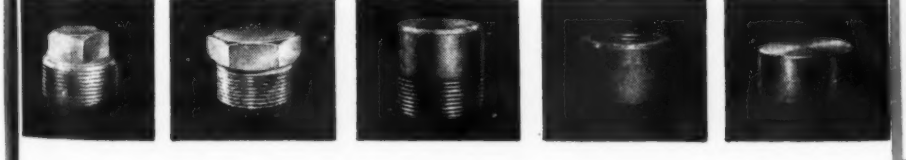
THE COMPLETE LINE of Watson-Stillman Forged Steel Pipe Fittings is manufactured under the same *Quality* procedures that have characterized all Watson-Stillman products during 97 years of experience in dealing with high pressures. Available to you in Screw and Socket Welding types—in Carbon Steel, Carbon-Molybdenum Steel, Chromium-Molybdenum Steel, and Stainless Steel. The Double-Diamond trade mark is your guarantee of *"Performance-Proved" Quality.*

FORGED STEEL SCREWED FITTINGS

Long threads, accurately cut, perfectly aligned, for quick, easy installation. Uniform wall thickness throughout assure a higher factor of safety. Long low bands extend beyond last thread to insure extra strength and better wrench grip. Sizes: ⅛" through 4" I.P.S., 2000 — 3000 — 6000 Pound Classes.

SOCKET WELDED TYPE

Speed up and simplify installation because deeper sockets eliminate necessity of cutting pipe to exact lengths. The deep socket furnishes support for the pipe and provides self-alignment. No special fixtures are needed for lining up and holding joints. PROVED WELDABILITY. Sizes: ¼" through 4" I.P.S. For Schedule 40—80—160 and XX Pipe.



WATSON-STILLMAN

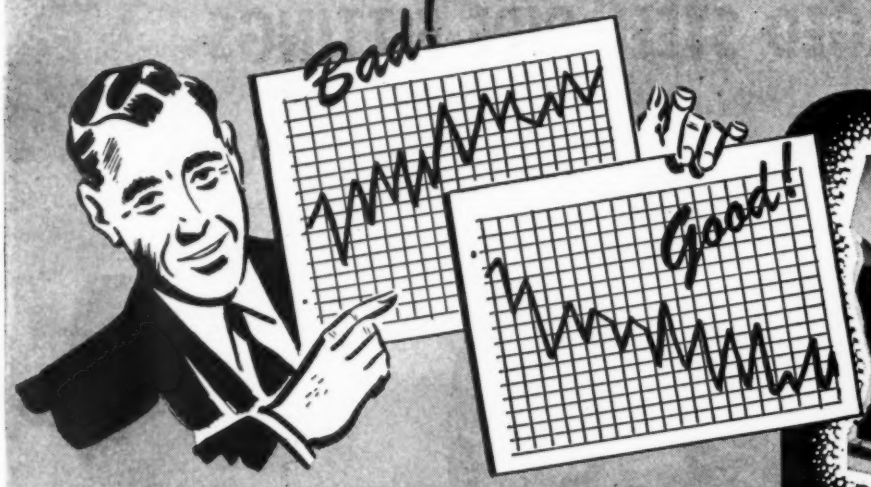
ROSELLE, NEW JERSEY

Distributor Products Division

Designers and Manufacturers of Forged Steel Fittings, Valves, Wire Rope Shears, Pumps, Jacks, Pipe Benders and Hydraulic Equipment

MARK OF QUALITY

FITTINGS • VALVES • WIRE ROPE SHEARS • PUMPS • JACKS • ***Sold Through Leading Distributors***

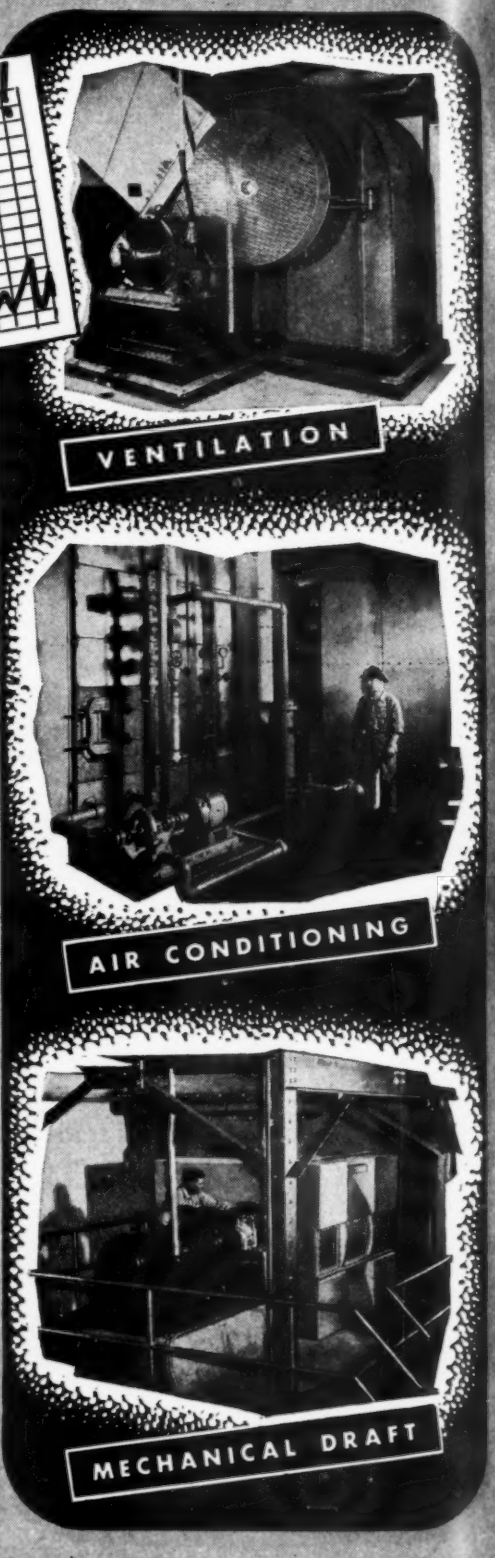


WHICH WAY ARE YOUR COSTS RUNNING?

What leading engineers have long known, the war has proved . . . *the right temperature, the right humidity, and a high degree of air cleanliness are mighty important factors in reducing production costs.*

Today, where bombers and guns are built, where penicillin, sulfa and other vital drugs are made, where films, gasoline, rubber, steel, rayon and scores of other war necessities are being manufactured — Clarage Air Handling and Conditioning Equipment helps maintain uniform quality of product, and helps keep workers AT WORK . . . *in short, increased production, and increased production invariably results in LOWER factory costs.*

What about YOUR plant? If you're in essential work, we can help you now. At least you should be thinking about air conditioning, heating, and cooling, for postwar — to meet keen postwar competition. Why not let a Clarage engineer go over your situation soon? Write us today — no obligation, of course!



ARMY E NAVY

CLARAGE

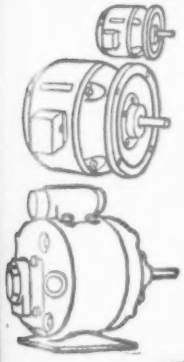
FAN COMPANY

Kalamazoo, Michigan

APPLICATION ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

★ ★ BUY MORE WAR BONDS ★ ★

MOTORS AND Control



For your plant or for use as built-in components of your product, Graybar offers General Electric motors of both integral and fractional horsepower types — and matching control units, including the latest electronic types. Today, for essential war uses . . . tomorrow, for every motor need. A Graybar Power Apparatus Specialist in your area is ready to give you experienced aid in their selection and application. *Graybar Electric Company, Graybar Building, New York 17, N. Y.*

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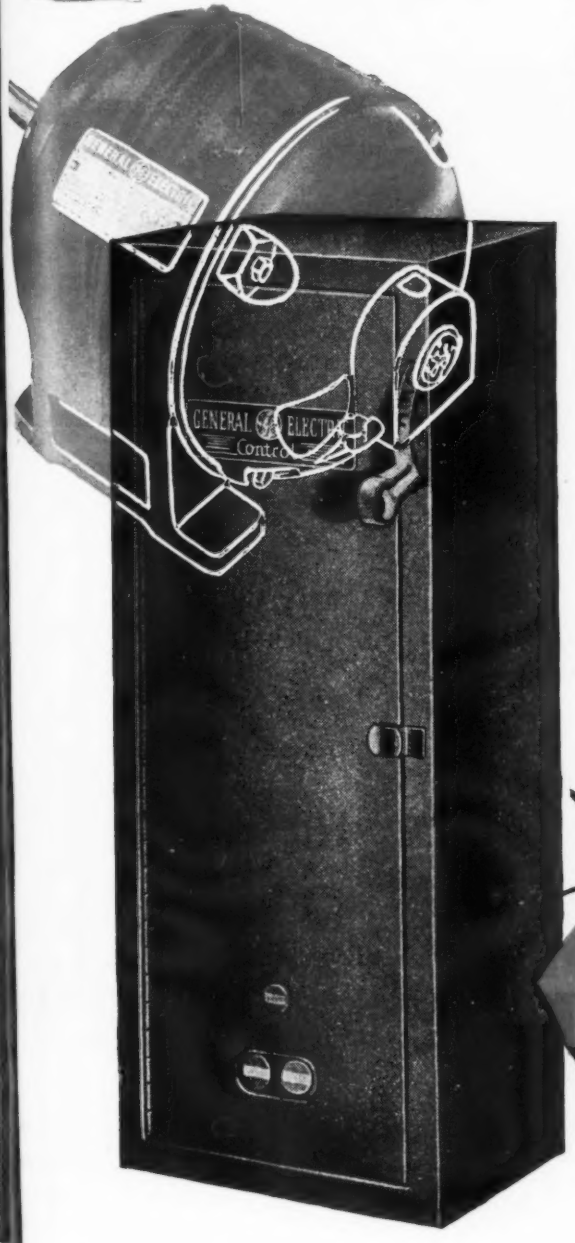
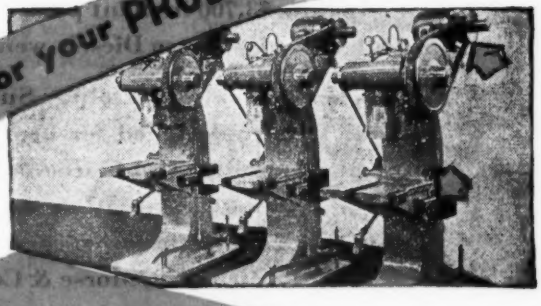


. . . for your PLANT

. . . for your PRODUCT

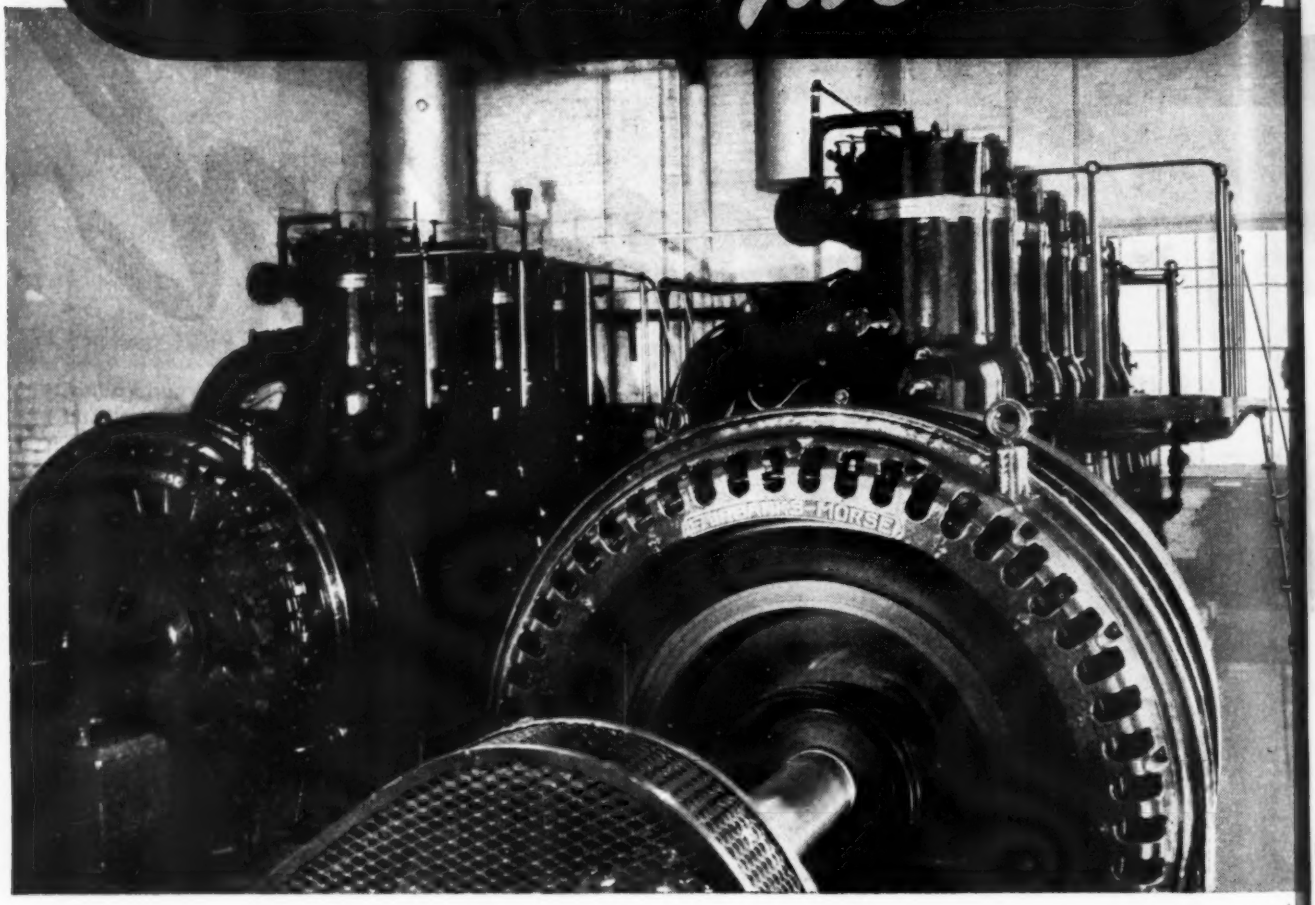


Via Graybar

. . . the Double-Duty Source of Supply

In Over 80 Principal Cities

Diesel Demonstrates $3,700 Saving – Company Buys *Two* More!



JUST one year of Diesel operation saved the makers of Valdura heavy-duty maintenance paints $3,700 in plant power costs. So, as expansion plans went into effect, two more Fairbanks-Morse Diesels went into operation.

This is a typical experience. Such performance is built into Fairbanks-Morse Diesels. They're designed for heavy duty, economical operation, low maintenance costs, and long life. And Fairbanks-Morse Generators are built the same way. Fairbanks-Morse power generating units are engineered before you get them. One maker is responsible, one guarantee covers them. For information on how you can save on power, write Fairbanks, Morse & Co., Fairbanks-Morse Building, Chicago 5, Illinois.

BUY MORE WAR BONDS

Fairbanks-Morse

A name worth remembering

Diesel Locomotives • Diesel Engines • Generators • Motors • Pumps
Scales • Magnetos • Stokers • Railroad Motor Cars and Standpipes

. . . How to REDUCE Drive Maintenance COSTS

COMPRESSOR INSTALLATIONS impose frequent and heavy shock loads on belts, bearings and motors causing excessive maintenance and replacement costs. American Econ-o-matic Drives make these costs unnecessary because they provide automatic belt tension control to meet every variation in the load and to cushion every shock.

Here is a case where an idler pulley was discarded in favor of an Econ-o-matic Drive because the idler failed to stop belt slippage which, together with the double flexing of the belt, caused excessive belt wear and failure. The Econ-o-matic Drive, eliminated slippage, increased belt life and cut maintenance to the minimum.

By utilizing the natural torque reaction of the motor, Econ-o-matic Drives permit the load to govern the tension—tightening the belt on heavy loads and loosening the belt when the load slacks off. They provide exactly the right amount of tension at all times for the most effective use of available power.

AMERICAN *Econ-o-matic* DRIVES

Made for jobs up to 250 hp...Increase machine output . . . Save power . . . Cushion shock and starting loads . . . Cut maintenance man-hours.

Write for Econ-o-matic Handbook

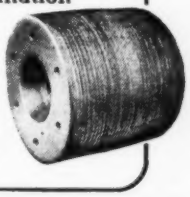
It shows how to solve many drive problems . . . Gives full drive selection tables and installation data. Send for your copy today.

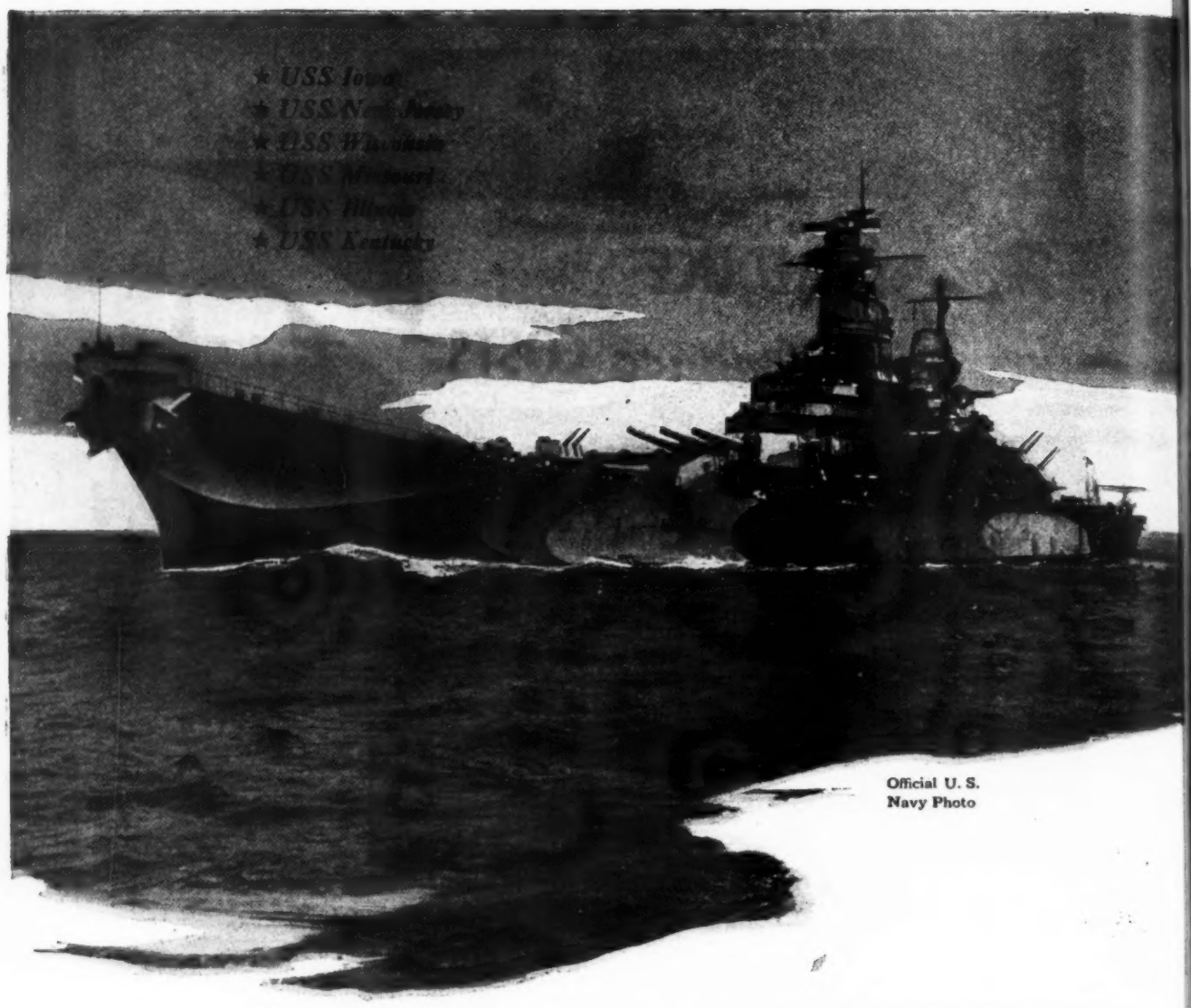
The American Pulley Company

4224 WISSAHICKON AVE., PHILADELPHIA 29, PA.

An Ideal Pulley Combination

American Steel-Split Pulleys and Hi-Torque Motor Pulleys are a true-running "team" that give you highest gripping power . . . longer life . . . dependable service. Write for catalogs.





Official U. S.
Navy Photo

☆ SUPER BATTLESHIPS USE SUPER PUMPS

Each of the six super battleships of the Iowa class is fitted with twelve Ingersoll-Rand Cameron main boiler feed centrifugal pumps.

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y.

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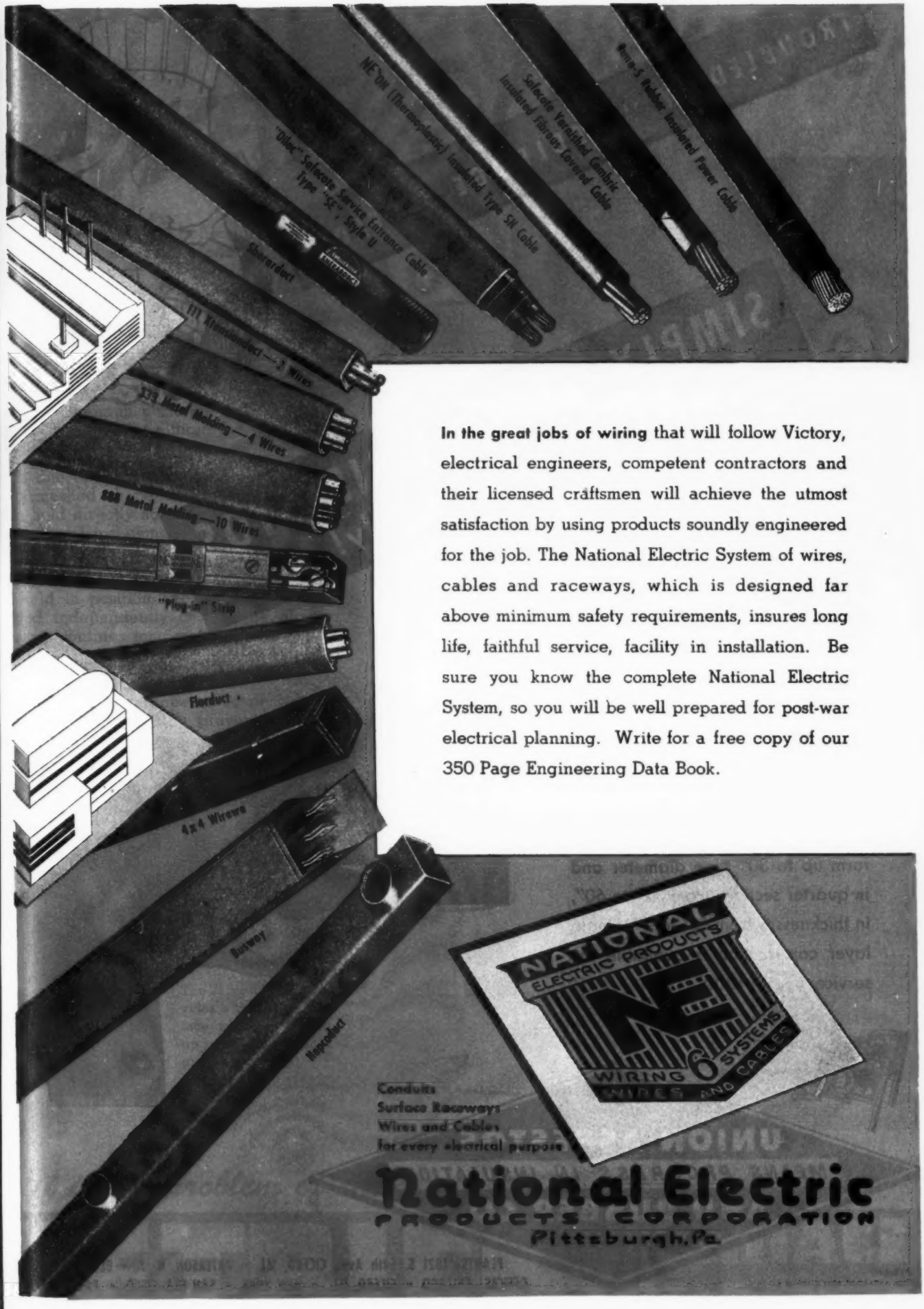
CENTRIFUGAL PUMPS • CONDENSERS • COMPRESSORS • TURBO BLOWERS • ROCK DRILLS • AIR TOOLS • OIL AND GAS ENGINES



In the great jobs of wiring that will follow Victory, electrical engineers, competent contractors and their licensed craftsmen will achieve the utmost satisfaction by using products soundly engineered for the job. The National Electric System of wires, cables and raceways, which is designed far above minimum safety requirements, insures long life, faithful service, facility in installation. Be sure you know the complete National Electric System, so you will be well prepared for post-war electrical planning. Write for a free copy of our 350 Page Engineering Data Book.

SIMPLY APPLY UNIBESTOS

it's simple to apply!

Unibestos, the sectional insulation, will not dent, shatter, sag or gap as the result of vibration, exposure to moisture or hard knocks. This greater structural strength is a result of Unibestos' resilient, tough fibrous construction.

Unibestos is available in half-section form up to 30" pipe diameter and in quarter sections from 32" to 60", in thicknesses from ¾" to 5". Single layer construction is available for service up to 1200°.

UNION ASBESTOS
MEANS PROGRESS IN INSULATION
AND RUBBER CO.

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PLANTS: 1821 S. 54th Ave., CICERO, ILL. • PATERSON, N. J. • BLUE ISLAND, ILL.
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DETRICK SUSPENDED CONSTRUCTION

ABOVE THE FURNACE

Many operators of large boilers have had difficulty in maintaining full capacity because of infiltration through the upper firebrick walls. The very nature of firebrick causes it to move, especially when there are large areas with varying temperatures.

There are other operators who put in Detrick Suspended Walls behind the tubes and in the upper furnace area. They have found that they can get maximum performance and maintain peak loads without difficulty.

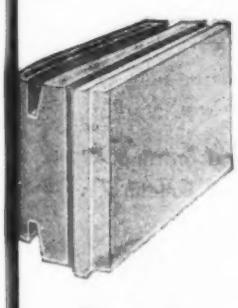
The airtightness of these Detrick Suspended Walls is due to the suspended construction, the intermeshed shape of the tile, the insulation held directly against the back of the tile, and the casing cement which is applied on the outside with a trowel.

The suspended construction by which each tile is held in position and each section is supported independently of the one above and below confines temperature movements to small areas and thereby avoids strains and cracks.

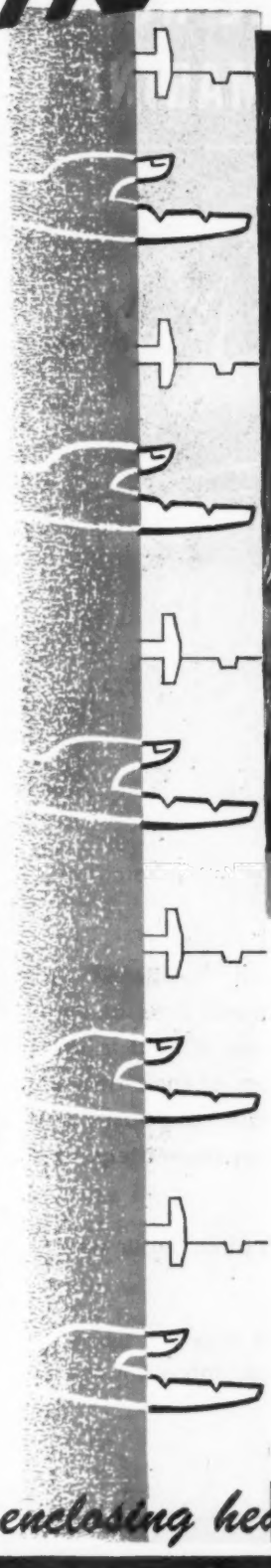
The entire wall is engineered to provide a heat-tight enclosure which prevents air infiltration and reduces heat loss to a minimum.

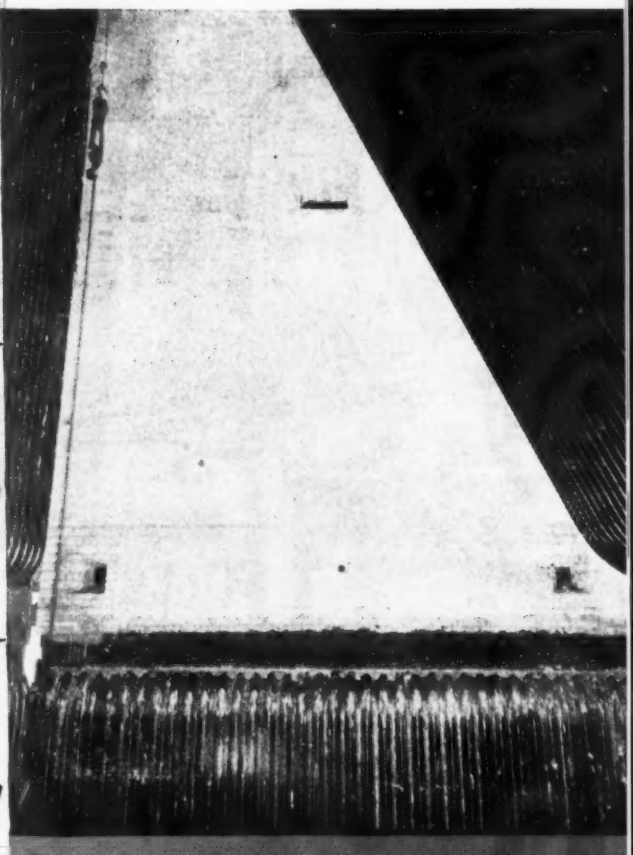
For improvement in present construction or for post-war plans, consult Detrick engineers on your furnace enclosure problems. Send us your blueprints for suggestions and ask for the new booklet "Detrick Furnace Enclosures" which will bring you up to date on this important subject.

M. H. DETRICK COMPANY
11 West Washington Street Chicago 2, Ill.

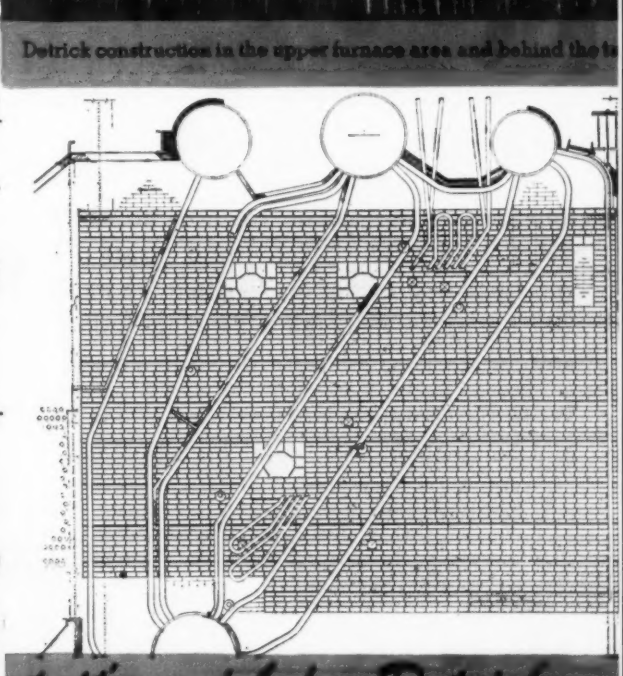


The Thinsulite Tile provides a thin refractory face which is backed up by insulation and a plastic casing.





Detrick construction in the upper furnace area and behind the t



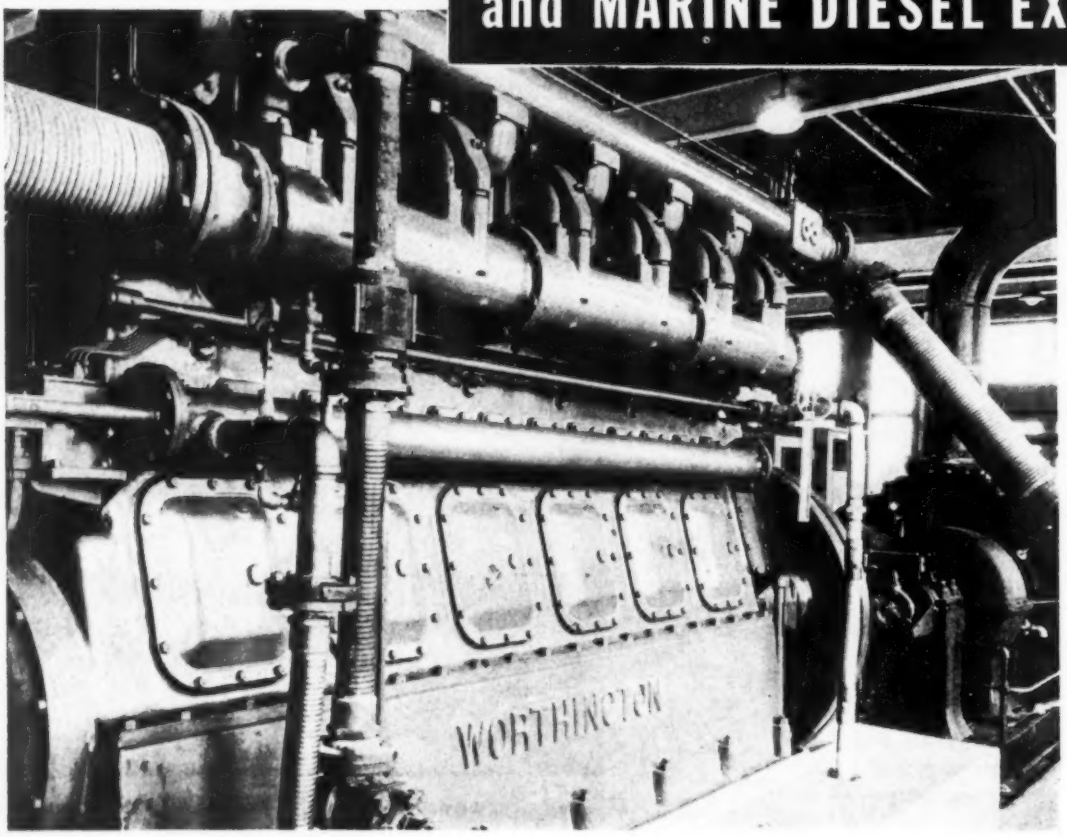
If it's a problem of enclosing heat, it's a job for Detrick

DETRICK FURNACE ENCLOSURES

USE DETRICK INSULATION . . . PLASTIC or BLOCK

Now 24"

I.D. INTERLOCKED GALVANIZED STEEL HOSE for STATIONARY and MARINE DIESEL EXHAUSTS



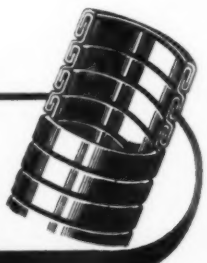
The new PENFLEX Asbestos-Packed, Interlocked, Pressure-Type Galvanized Steel Hose with an inside diameter of 24" is the largest hose of its kind in the country. Interlocked construction requires no special tools or heat to bend. Interlocked construction absorbs vibration and resists pulsations of load and pressure. Interlocked construction provides the flexibility to make installations easily and quickly. PENFLEX 24" has a recommended bending radius of approximately seven times its diameter. A working pressure of 15 to 25 psi.

Write our Engineering Department for details about your next installation of flexible connections for Diesel Installations.

PENFLEX Hose and Tubing are also available for Fuel Oil and Starting Air Lines, Lubricating Oil and Circulating Water Lines. Write for Bulletin 71.

PENFLEX METAL HOSE

PENFLEX



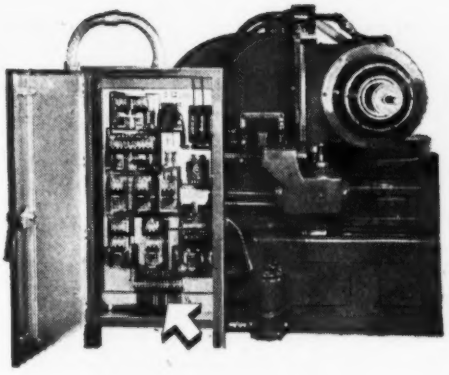
PENNSYLVANIA FLEXIBLE METALLIC TUBING CO.

7238 POWERS LANE Established 1902 **PHILADELPHIA 42, PA.**

Here's Why MORE AND MORE MACHINE TOOL USERS ASK FOR...

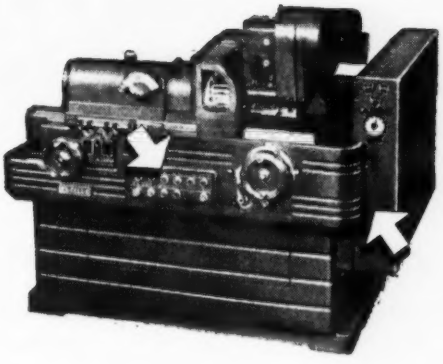
Square D Control

Because the Square D line of machine tool control is so unusually complete, practically any performance requirement can be met with standard devices. These standard devices, designed to perform many different functions, are physically proportioned to make up compact, attractive control panels.



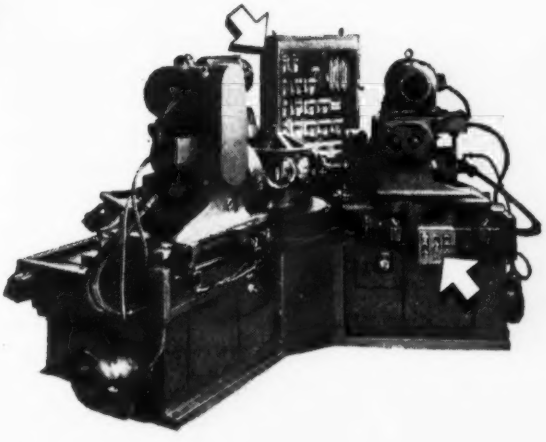
Square D Control

Magnetic starters and contactors, vertical action type, are designed specifically for the exacting requirements of machine tool control which include ample electrical capacity, fast response and long mechanical life. Square D accessories include push buttons, precision limit switches, pneumatic timing relays and terminal blocks.



Square D Control

Square D Field Engineers have had years of experience in designing electrical control for machine tools. They are fully qualified to work out line diagrams for desired operation sequences. Their suggestions are carefully analyzed and confirmed by factory engineering departments with complete research and testing facilities at their command. This Field Engineering Service is available, at no cost, through Square D branch offices in 50 principal U. S. and Canadian cities.

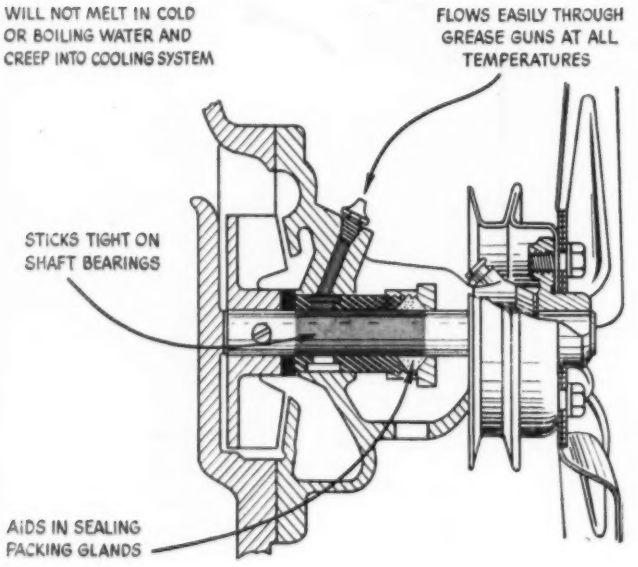


SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

CALOL RPM
STANDARD ENGINEERS NOTEBOOK
VOL. 2-E No. 2

Waterproof grease prevents clogging


WILL NOT MELT IN COLD OR BOILING WATER AND CREEP INTO COOLING SYSTEM
FLOWS EASILY THROUGH GREASE GUNS AT ALL TEMPERATURES
STICKS TIGHT ON SHAFT BEARINGS
AIDS IN SEALING PACKING GLANDS

Where truck and other engines are equipped with grease-lubricated water pumps in which cooling water comes in contact with grease, RPM Water Pump Grease is recommended.

RPM Water Pump Grease is especially compounded to make it waterproof. Neither hot nor cold water will change its characteristics. Because it has an extremely high melting point, high engine temperatures and boiling water will not cause it to melt and creep into the cooling system. Thus, the formation of grease scum on water, which tends to clog radiator tubes and other passages, is prevented.

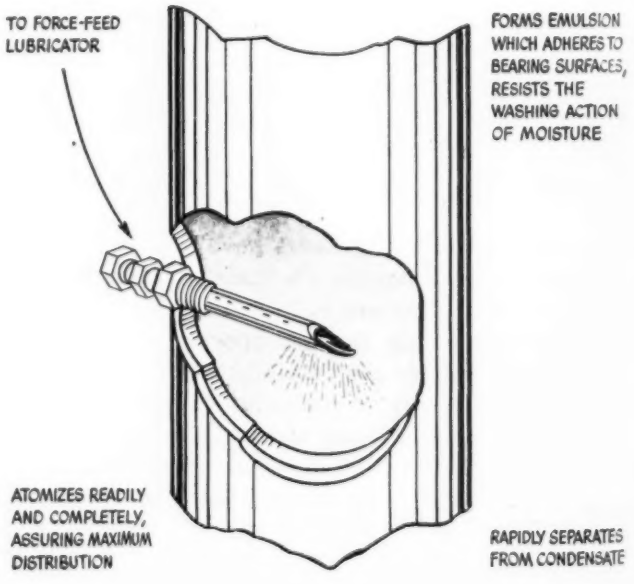
Highly resistant to change in structure, RPM Water Pump Grease sticks tight on whirling pump shafts. This not only prevents waste, but assures lubrication of pumps over extended periods. It forms a waterproof seal in glands, preventing leaks, keeps a protective film on bearings, and pumps freely through grease guns in all seasons.

Oil reduces boiler trouble

Because it will separate rapidly from water, Calol Cylinder Oil-135 FX is specially recommended for use in steam cylinders of engines in condensing steam plants, heating plants, distilled water ice plants and marine engines where the condensate is returned to the boiler. This oil is adaptable for steam pressures up to 160 pounds gauge and temperatures not exceeding 375° F.

Calol Cylinder Oil-135 FX is lightly compounded, well filtered, and of medium viscosity. It is one of a large group of steam cylinder and valve oils manufactured by Standard of California. In this group there is an oil to meet individual operating conditions in every plant—temperatures from 240° F. to 800° F. and pressures as high as 650 pounds.

A handy booklet containing information about each oil, "Vital Protection For Industrial and Marine Equipment" is available, free. Write Standard of California, 225 Bush Street, San Francisco, 20.


TO FORCE-FEED LUBRICATOR
FORMS EMULSION WHICH ADHERES TO BEARING SURFACES, RESISTS THE WASHING ACTION OF MOISTURE
ATOMIZES READILY AND COMPLETELY, ASSURING MAXIMUM DISTRIBUTION
RAPIDLY SEPARATES FROM CONDENSATE

STANDARD OF CALIFORNIA

THIS BIG FAMILY OF

Intelin

High Frequency Cables

MEASURES TO EVERY HIGH STANDARD

A big family – 29 types of high frequency cable – yet so high are their standards of construction and performance that every one of the following Intelin High Frequency Cables meets all the requirements of the most exacting specifications:

1. **Coaxial, Solid-dielectric, Semi-flexible Lines: *RG-5/U, 6/U, 8/U, 9/U, 10/U, 11/U, 12/U, 13/U, 14/U, 15/U, 17/U, 18/U, 19/U, 20/U, 29A/U, 54/U, 54A/U, 58/U, 59/U.**
2. **Coaxial, Air-spaced, Low Capacitance Lines: 7/U, 62/U, 63/U.**
3. **Coaxial, Attenuating Lines: RG-21/U, 42/U.**
4. **Coaxial, High Impedance, Spiral Delay Line: RG-65/U.**
5. **Dual (balanced) Lines: RG-22/U, 57/U.**
6. **Dual-coaxial, Highly Balanced Lines: RG-23/U, 24/U.**

*Type number designations are those of the Army-Navy R. F. Cable Coordinating Committee.

To date, for every new high frequency cable need, Intelin has developed and produced the answer. Whatever your requirements in high frequency cable, consult Federal first.

FEDERAL TELEPHONE & RADIO — FTR

Federal Telephone and Radio Corporation

AN IT&T ASSOCIATE

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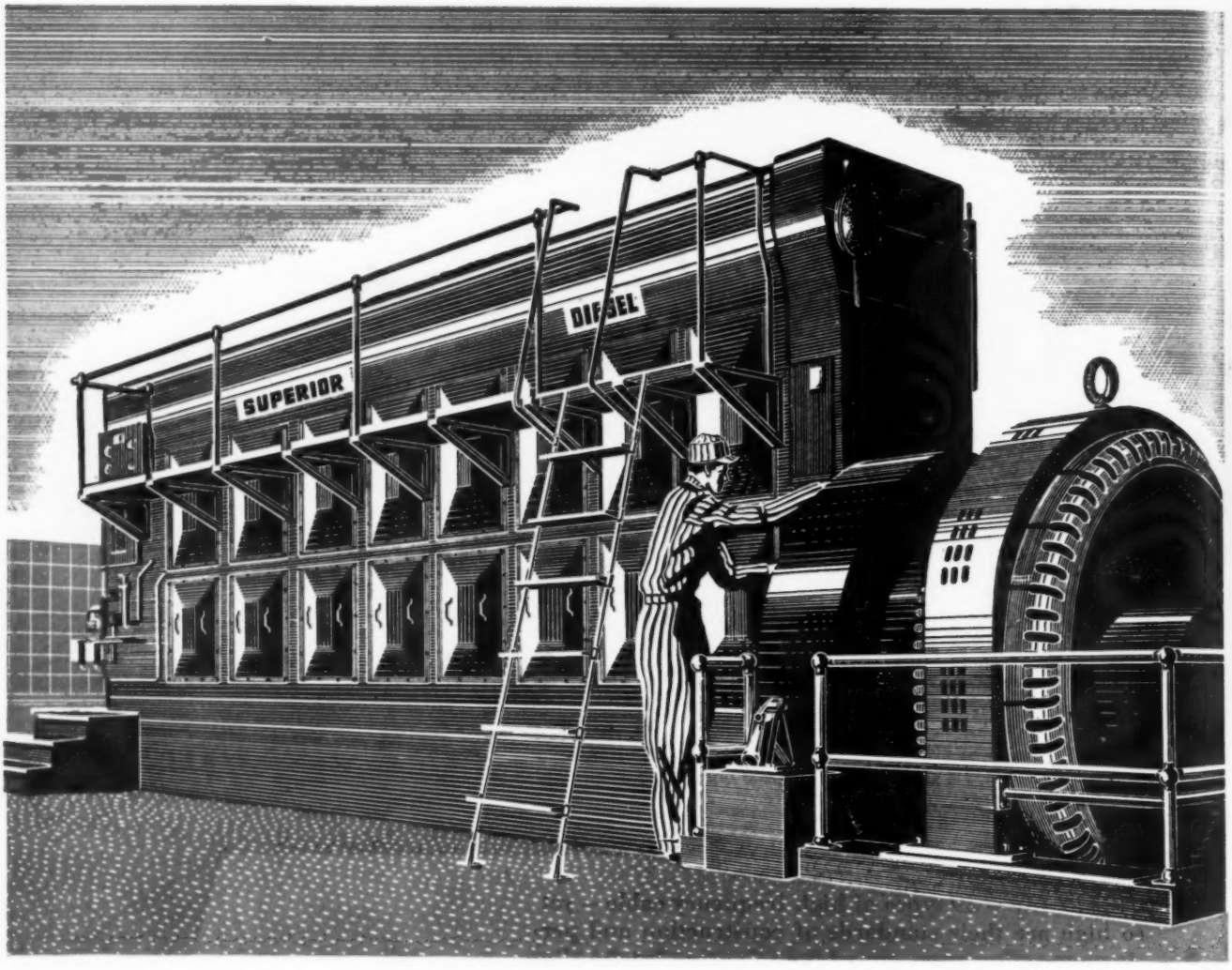

WORLD POWER IN ONE WORD . . . *Superior*

THE constructive energy of Superior Gas, Oil and Diesel Engines is aiding progress and developing resources in almost every country in the world.

In Russian oil fields . . . on South American rivers . . . within the Arctic Circle and deep in tropical jungles, the surging power of Superior Engines is helping man forge ahead to new achievements. Thousands of Superior Engines serve America's great industrial, marine, agricultural and municipal power needs. In the range of Superior Gas, Oil and Diesel Engines from 10 H.P. to 1325 H.P., there are models to meet a wide variety of requirements for steady, economical power.

Superior **ENGINES**
Division of
THE NATIONAL SUPPLY CO.
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SUPERIOR DIESELS • STATIONARY, 10 to 1325 H. P.
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THE PAST FORETELLS THE FUTURE

Your copy of this fine book is now ready. You will want it as a guide for the future.

The best guide for your future relations with a man is his reputation in the past.

So it is with business institutions.

Today, more than ever before, every individual business must depend on other individual businesses. And that dependence can, and should, be placed only upon those business institutions whose record of performance as to policy, product, service and general attitude has been flawless in the past.

Many new businesses exist today. Many others, old in years, have not kept young in thinking . . . and are passing from the national picture. This has been the history of business since the world began.

Yet, through all the economic changes, certain institutions have grown old in years, but have kept young in spirit and have constantly improved upon their original reason for existence.

The book illustrated above deals with the history of The Falk Corporation, its ideals, accomplishments, and plans for the future so far as those plans can now be projected.

You, too, in your effort to render a service to your industry, must of necessity have followed many of the principles set forth in this book. For that reason we believe that the book will interest you and will provide you with reasons why The Falk Corporation will be a sound source of supply for the machinery you will need to shave pennies from production costs and improve your product, in order to compete in the salesmen's war to come.

THE FALK CORPORATION, *Milwaukee 8 Wisconsin*

IT ALWAYS PAYS TO CONSULT **FALK** . . . A GOOD NAME IN INDUSTRY

For over fifty years
Precision Manufacturers of
Speed Reducers • Motoreducers • Flexible Couplings • Herringbone and Single Helical Gears • Heavy Gear Drives
Marine and Diesel Engine Gear Drives and Clutches • Steel Castings • Contract Welding and Machine Work.

District offices, representatives, or distributors in principal cities.

For Cooling—

LUBRICATING OIL
TRANSFORMER OIL
DIESEL JACKET WATER
CIRCULATING WATER
WASTE LIQUORS

ONE OF A SERIES OF ADVERTISEMENTS DESCRIBING THE MANY TYPES OF G-R HEAT TRANSFER APPARATUS

THE G-R MULTIWHIRL COOLER

The important advantages of the G-R Multiwhirl Cooler for cooling . . . for heat recovery . . . for heat transfer . . . on many liquid services have been proven in thousands of installations.

Some of these advantages: MINIMUM PRESSURE DROP . . . because of the correctly proportioned baffle system. MULTIPLE CONVENIENCES . . . because of the ease of installation, inspection, and cleaning. LASTINGLY SATISFACTORY SERVICE . . . because of freedom from expansion and contraction strains and provisions against leakage.

If your power-generating equipment or plant processes require cooling of liquids, be sure to investigate the G-R Multiwhirl Cooler. Write for Bulletin 710 describing these units in detail.

G-R BUILDS ALL THESE UNITS FOR HEAT TRANSFER SERVICE . . .

Evaporators
Stage Heaters
Gas Coolers
Drain Coolers
Aftercoolers
Air Preheaters
Fuel Oil Heaters
Jacket Water Coolers
Process Heat Exchangers
Transformer Oil Coolers
Generator Air Coolers
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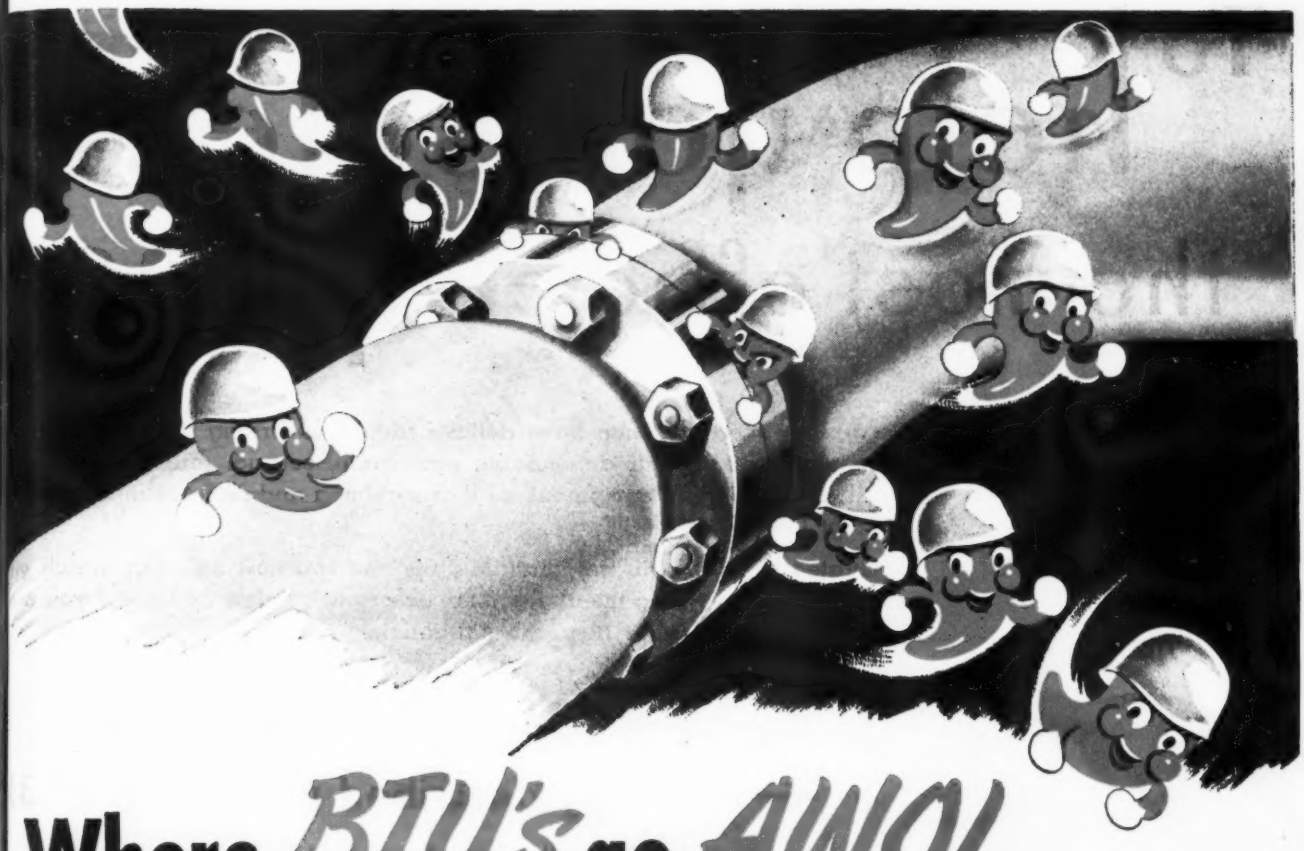
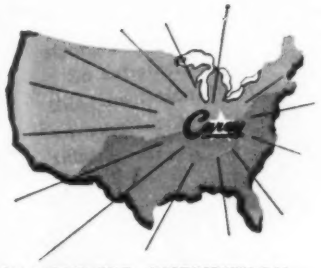
THE GRISCOM RUSSELL CO.
285 Madison Ave., New York 17, N. Y.

GRISCOM-RUSSELL
Pioneers in Heat Transfer Apparatus



Where BTU's go AWOL



NATIONWIDE DISTRIBUTION—Warehouse stocks of the broad Carey Line provide service regardless of job location.

CAREY INSULATION ENGINEERING SERVICE makes available the knowledge and experience of leading authorities.

IT'S costly . . . the way those pesky BTU's keep trying to sneak off the job. For example: one pair of bare, 10-inch flanges at 350° F. can waste a ton of coal a year.

Carey Industrial Insulations keep BTU's where they belong . . . on the job. Carey makes a broad line of asbestos, magnesia and rockwool insulations . . . in forms that make either ordinary or tricky jobs fast, economical, dependable and efficient.

Put your insulation problems up to Carey Insulation Engineers. They're ready to help you with expert guidance based on more than 70 years experience in industrial insulation. Consult your nearest Carey branch or write direct.

TRAINED ERECTION AND SERVICE CREWS "make sure" the job is done right.

BROAD LINE FROM ONE SOURCE. No need to compromise with desired results. You get the *right* insulation for the job.

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To help you select the most efficient fans

Most plant operating men have definite ideas concerning fans and blowers. They want, first of all dependable equipment, second, efficient equipment and third, accessible equipment, so that servicing and maintenance costs can be kept low.

Illustrated here are two new Buffalo Fans and two new Bulletins which give complete data covering them. Read the description below and see if you need these bulletins for your files. No obligation.

The NEW Type "B" Axial Flow Fan

← fully described in Bulletin 3533

was designed to fill the need for a duct-mounted fan for the light duty common to ventilating and air conditioning service, that is for static pressures from ¼" to 1½". Made in nine sizes, up to 48" diameter, in belted-drive and direct-drive models, with or without vanes, the new Type "B" line offers quiet, efficient, reliable performance at moderate cost.

NEW Pressure Blowers and Centrifugal Compressors described in Bulletin 3553 →

These new heavy duty blowers have a wide range of application—handling air for oil or gas furnaces, on high pressure installation in glass, steel and chemical plants, for scale and water blow-off problems, experimental work, etc. They are suitable for pressures up to 4# per square inch. Newly developed rotors give efficient, trouble-free operation. Alloy construction of all or part of each blower is practical.

For Bulletins, Write

Buffalo Forge Company

438 Broadway Buffalo, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

ARMY E NAVY

"Buffalo"

"First For Fans"

fans for industry

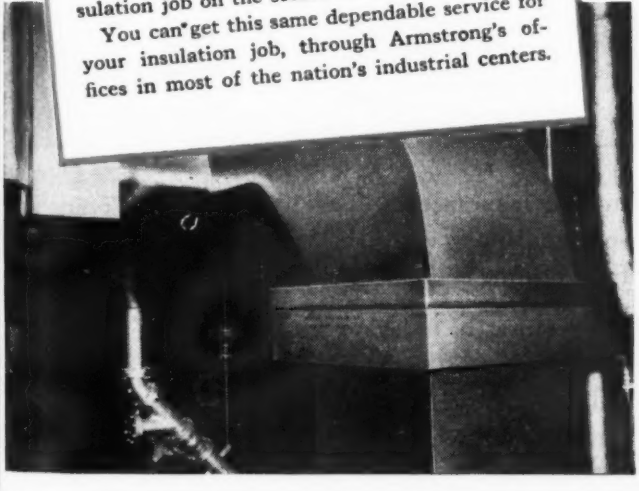
You know every detail is right with
ARMSTRONG'S CONTRACT SERVICE
FOR HEAT INSULATION

O. K. from F. W. to I. D.

From feed water lines to induced draft exhaust gas ducts, all piping and equipment in the first unit of a giant electric power plant in the East was insulated a year ago by Armstrong's Contract Service.

So satisfactory has been the performance of this insulation, that contracts were recently awarded to Armstrong to do the complete insulation job on the second unit.

You can get this same dependable service for your insulation job, through Armstrong's offices in most of the nation's industrial centers.



SHOWN ABOVE is the 19th stage heater covered with 1½" magnesia and ½" cement (hard finish). Below, section of primary air duct with expansion joints covered with 1½" high temperature insulation, 1" magnesia block, and ½" asbestos (hard finish).

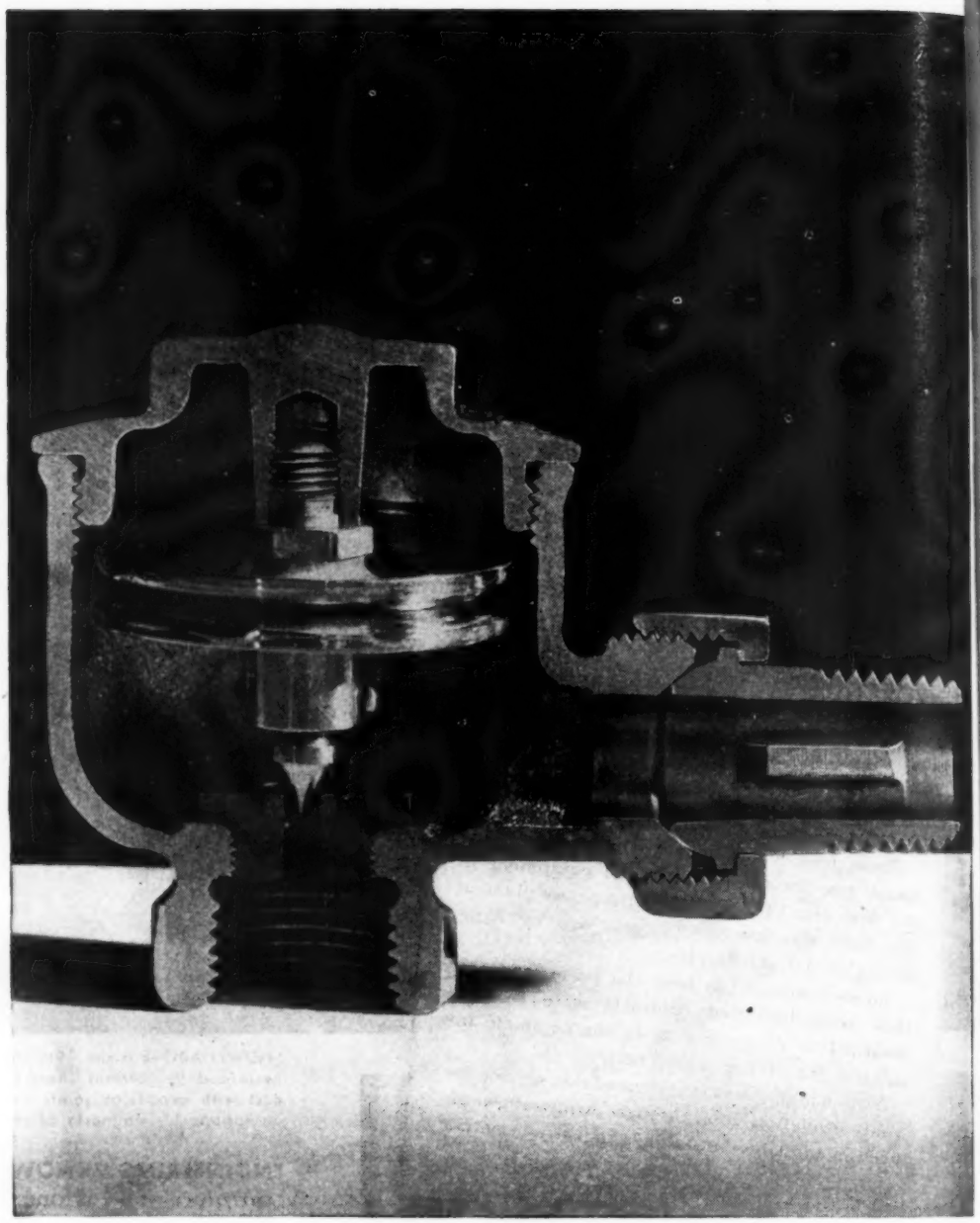
ENGINEERING "KNOW-HOW"—applied to the *complete* job—is one of the big advantages you gain when you use Armstrong's Heat Insulation Contract Service. With Armstrong engineers on your job, you get the benefit of years of experience in planning the application and erection of insulation. In addition, Armstrong's complete service provides materials of tested efficiency and skilled workmen to install them. The Armstrong organization takes full responsibility for every phase of the work—planning, supervision, materials, and workmanship—thus assuring that every detail is ***right***. For complete information, write today to Armstrong Cork Co., Building Materials Division, 7004 Concord St., Lancaster, Pa.

ARMSTRONG'S INDUSTRIAL INSULATION

Complete Contract Service
For All Temperatures

From 300° Below Zero

To 2600° Fahrenheit



Full Heat from Radiators

Webster Thermostatic Radiator Traps assure full heat from the steam delivered to radiators. There's no escape of "live" steam because Webster Traps allow only air and condensate to enter the returns. Designed for low pressure vapor and vacuum steam heating service, Webster Radiator Traps are noted for high efficiency and long service... Save fuel, save steam.

Available in three sizes—for 200 sq. ft., for 400 sq. ft., for 700 sq. ft. e.d.r. Webster Radiator Traps employ the time-tested Webster thermostatic element, a strong double diaphragm of phosphor bronze fully compensated for pressure. Maximum pressure is 25 lb. per. sq. in.

Webster Radiator Traps are extra heavy, extra rugged. Only the best of materials and workmanship are used in their manufacture. That's why Webster Traps are so easily able to withstand the severe service expected from heating equipment.

The features of today's Webster Traps are the result of more than 50 years steam heating experience. For full information on the longest-lasting traps available, consult your telephone directory for the address of the nearest Webster Representative. Or write us direct.

ADDRESS DEPT. P-4

WARREN WEBSTER & COMPANY, Camden, N.J.

Pioneers of the Vacuum System of Steam Heating :: Est. 1888

Representatives in principal cities :: Darling Bros., Ltd., Montreal, Canada

Fuel-Saving Starts With CONTROL

AUTOMATIC Webster Steam Heating

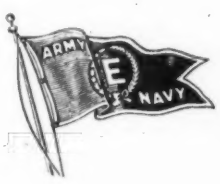
• INTRICATE PIPING DESIGNS
• EXACTING SPECIFICATIONS

Produced Only by
EXPERT SHOP FABRICATION

TYPICAL of the intricate and complex designs which modern scientific engineering and construction have brought into demand, is the prefabricated subassembly of piping shown above, which is used in a hydraulic piping system operating at a pressure of 2500 p.s.i. Its prefabrication brings into play all of the skill of experienced piping specialists, as well as the facilities and equipment required in modern shop fabrication.

Here at Pittsburgh Piping & Equipment Company, a carefully systematized procedure is followed in every phase of shop-fabrication, from selection of proper materials to the final test and inspection of the completed assembly. This assures strict adherence to specifications and results in an infinitely better piping job both from the standpoint of mechanical excellence and economical operation.

If you have a piping problem involving a single unit or a complete system, our engineers will gladly work with you. Contact our nearest representative or write us direct.



Pittsburgh Piping
AND EQUIPMENT COMPANY
10 Forty-Third Street—Pittsburgh, Penna.

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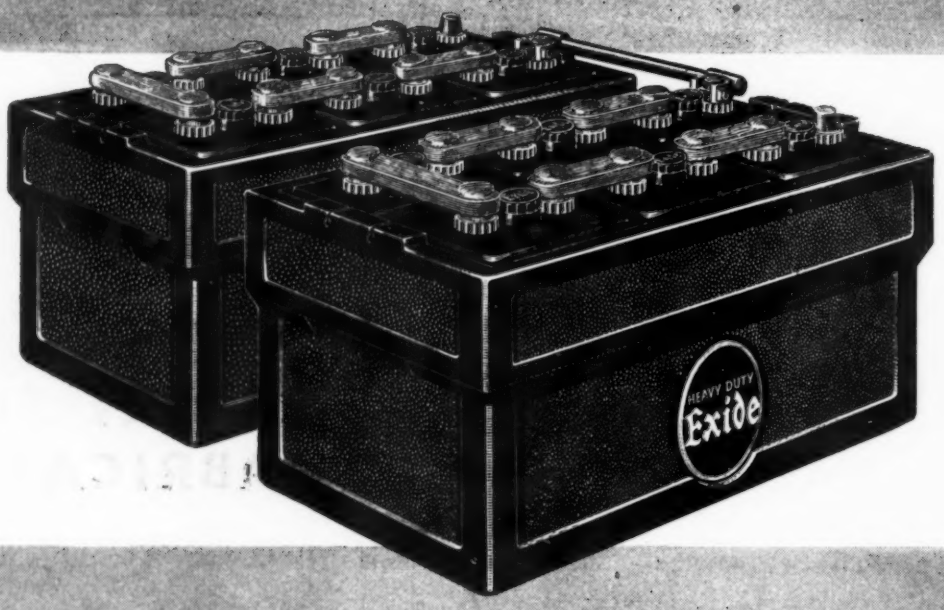
Do More Than Before—Buy EXTRA War Bonds

EXIDES—AS DEPENDABLE AS



THE DIESELS THEY CRANK

The dependable performance that operators have learned to expect from their Diesel engines is matched by equally dependable Exide Batteries. A result to be expected, for Exides are designed and built for this specific cranking job.

When Diesel engines first came into general use, there were Exide Batteries ready to do the cranking. And as Diesels developed in performance, Exide engineering kept pace, step by step. Today, in plants throughout the country, thousands of powerful, rugged Exides are on Diesel-cranking duty—serving with dependability, long-life and ease of maintenance.

Write for a FREE copy of the Exide Catalog on Heavy-Duty Batteries. It gives you catalog data and information on how to get the most from your Heavy-Duty Batteries.

ARMY E NAVY

Exide
BATTERIES
FOR CRANKING
DIESEL ENGINES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32
Exide Batteries of Canada, Limited, Toronto

Gilmer V-BELTS

They stand the heavy strain of 'round-the-clock service

Every structural detail of a Gilmer V-Belt is designed for long, hard service. Special compounds, developed by Gilmer research, thoroughly bond the strong pulling cords, keep them separated and riding in parallel, thus eliminating internal friction. And the heavy protecting jacket is extra tough and wear-resisting.

Gilmer V-Belts are precision moulded with so high a degree of exactness that they are "matched" to the same lengths within very small tolerances. They operate on any drive, under correct tension, without need for rematching. This feature, combined with a tight-holding grip, assures a steady, powerful pull . . . in low or high speed service . . . on long or short center drives.

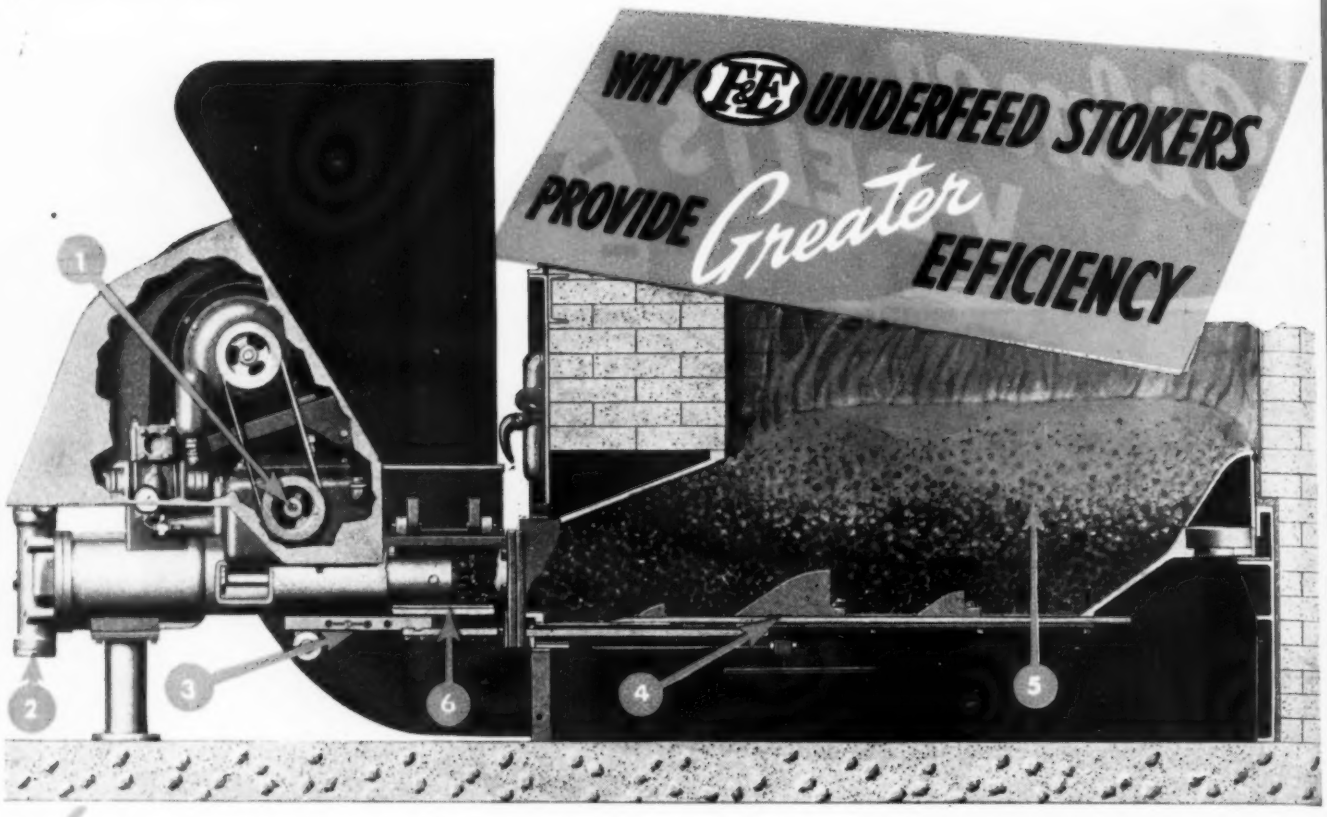
Gilmer has the largest assortment of V-Moulds in the world . . . FHP and multiple, endless and non-endless. Whatever your requirements, there is a Gilmer V-Belt to meet them.

Write for a FREE copy of the Gilmer Guide, the most complete V-Belt catalog in the field. It contains valuable engineering information, standard sheave and belt tables, and other useful data.

Gilmer makes a complete line of belts and belting for every power transmission need.

L. H. GILMER COMPANY
Tacony, Philadelphia 35, Pa.
Division of United States Rubber Company

Gilmer BELTS



6 ADVANCED ENGINEERING FEATURES PROVIDE EVEN FUEL DISTRIBUTION, PERFECT COMBUSTION, LOW OPERATING AND MAINTENANCE COSTS

1. **UNIT TYPE ELECTRO-HYDRAULIC DRIVE**—This type drive is an outstanding achievement in stoker design. One simple, compact mechanism—all self-contained—eliminating pipes, valves, fittings, shear pins, gears and other parts that usually leak, break, or give trouble. All moving parts are enclosed and operate in a bath of oil. Easy to keep clean. Absolutely protected against breakdowns should tramp iron and other foreign matter be fed in with the coal. Steam Drive Available.

2. **INTERVAL TIMER GOVERNOR (Patented)**—Standard equipment on all "F & E" Underfeed Stokers. Revolutionizes the feeding of coal by regulating the *time interval* between ram strokes, allowing the ram to operate FULL-STROKE, FULL SPEED at all times—a necessity in the efficient operation of an underfeed stoker. With this Governor, the operator can secure the *exact* rate of coal feed he desires.

3. **EXTERIOR FUEL BED REGULATOR**—The "F & E" Coal Distribution Regulator makes possible the regulation of the burning fuel bed from the OUTSIDE of the stoker in event of change in grade of coal . . . a further assurance of even distribution of fuel over the entire grate surface at all times.

4. **SLIDING BOTTOM RETORT**—Produces perfect underfeed action of the fuel from one end of the retort to the other. It is practically immune to distortion should the fire burn down into the retort.

5. **HIGH EFFICIENCY TUYERES**—Scientifically designed to produce efficient preparation and burning of fuel. Extremely large heat-radiating surfaces result in low maintenance.

6. **RENEWABLE RAM CASE LINER**—Ram operates in a steel liner fitted to the interior of the ram case. When wear results, original size can be restored quickly and economically by replacing the ram and liner. Another "F & E" feature designed to facilitate keeping the stoker always in best operating condition with a minimum of effort, expense and time.

This 6-FEATURE COMBINATION IS AVAILABLE ONLY IN "F & E" UNDERFEED STOKERS

Get in touch with the "F & E" representative in your locality or write direct to manufacturer for literature and case histories of what "F & E" Stokers have accomplished for others. Ask for Bulletin 1105.

FLYNN & EMRICH CO.

Established 1842

Holliday & Saratoga Sts., Baltimore 2, Md.

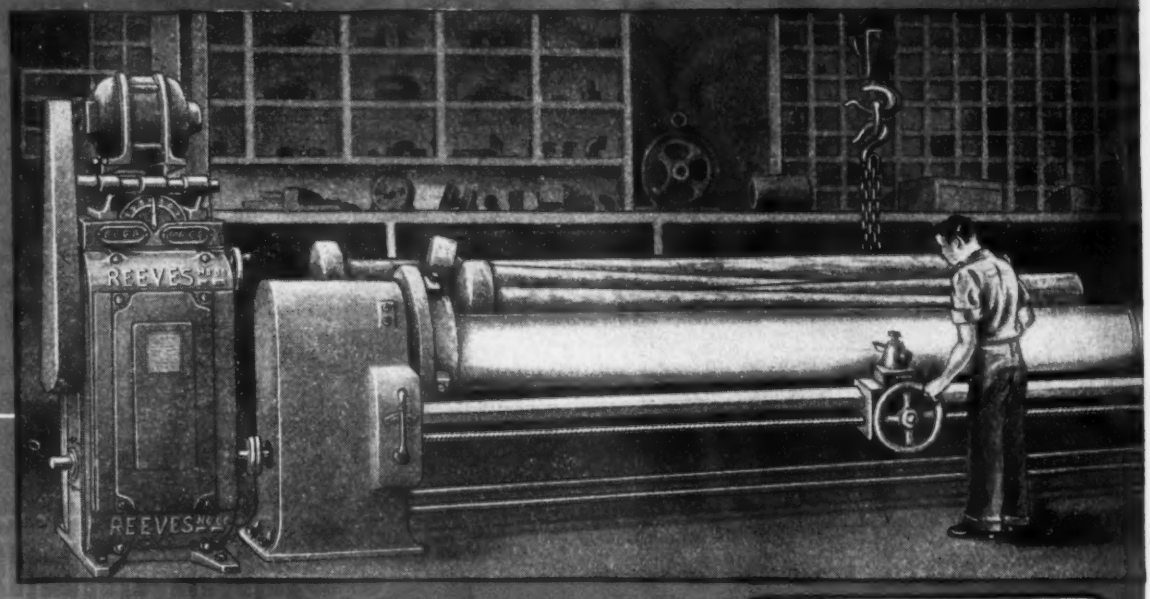
Representatives in Principal Cities

F&E **UNDERFEED STOKERS**

Bituminous and Anthracite Types—For Heating or Power Boilers Producing from 1,000 to 40,000 lbs. of steam per hour

★HOW REEVES STEPS UP PRODUCTION

OF PROPELLER SHAFTS FOR LIBERTY SHIPS



40-Hour Job Cut to 23 Hours by Applying Reeves Variable Speed Transmission to Lathe in Operation from 19 to 24 Hrs. Daily for 2 Years

● Typical of the ingenuity and "know how" which made America "The Arsenal of The Democracies" is the story about two small West Coast machine shops.

To machine the huge propeller shafts for Liberty ships, so urgently needed in the Pacific War, every possible facility was pressed into service. These shafts were from 13″ to 20″ in diameter, and from 17 to 22 feet long. They were too large for lathes ordinarily found on the West Coast, but this did not stop the shop owners.

The first shop converted a big old belt-driven lathe to provide modern controlled speed operation, with a large REEVES Variable Speed Transmission. Production was stepped up from one completed shaft every 40 hours, to one finished every 23 hours.

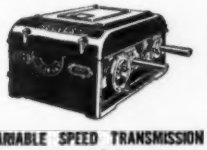
The ingenuity of the other shop proprietor was equally interesting. He built his own lathes out of concrete and old automotive parts, and with controlled speed provided by REEVES transmissions, is turning out finished shafts in greatly increased numbers.

In both of these applications REEVES Speed Control made possible the maximum peripheral cutting speed at every stage of the processing of these lathes.

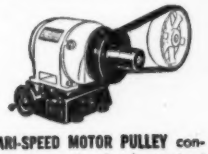
Here again, the adaptability, accuracy and rugged strength of REEVES Speed Control contribute to the war effort. Write for copy of 96-page Catalog P-450.

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

THE 3 BASIC REEVES UNITS



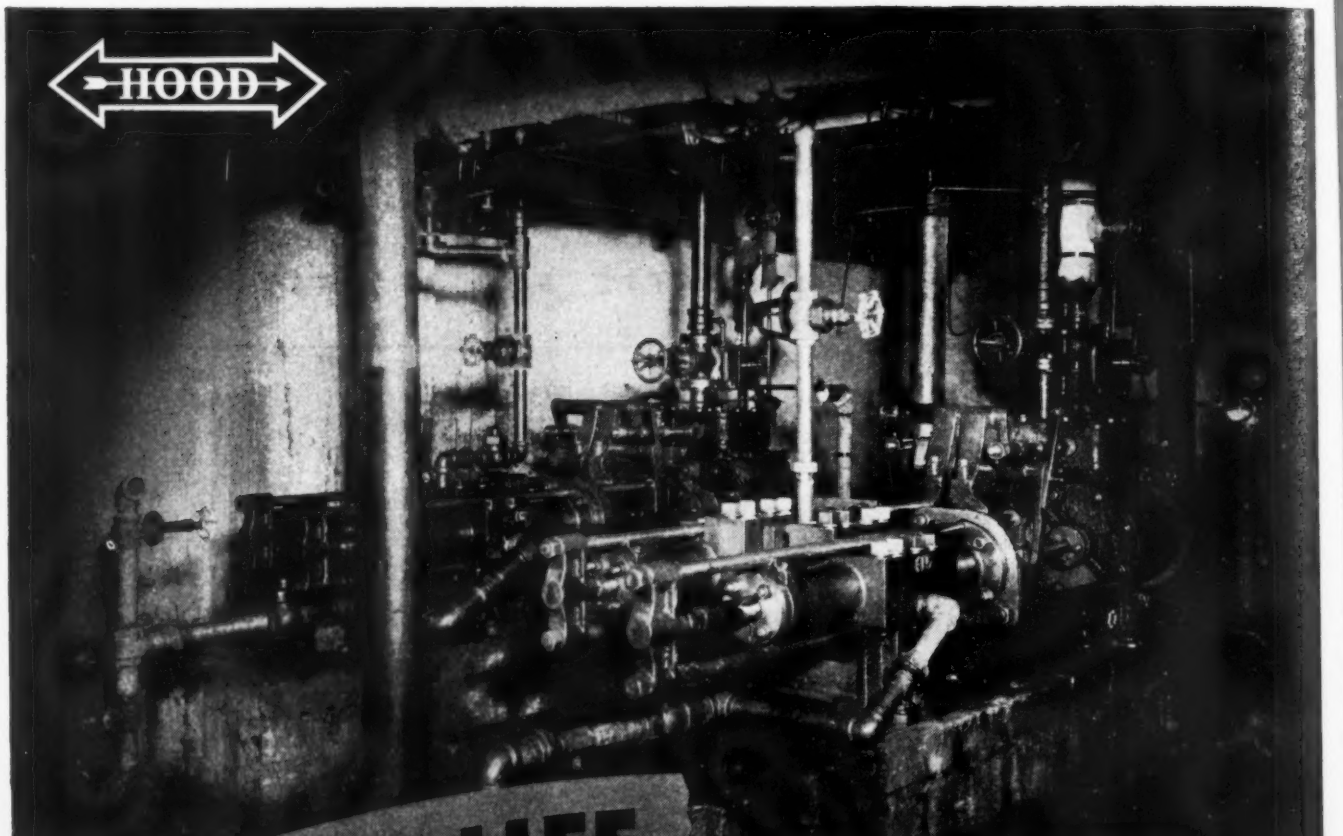
VARIABLE SPEED TRANSMISSION for providing infinite, accurate speed flexibility over wide range—2:1 to 16:1 inclusive.



VARI-SPEED MOTOR PULLEY converts any standard constant speed motor to a variable speed drive within 4:1 ratio.

MOTODRIVE combines motor, speed varying mechanism and reduction gears in single unit, speed ratios 2:1 to 6:1 inclusive.

REEVES *Accurate Variable* **SPEED CONTROL**



HOOD

LONGER LIFE WITH MINIMUM MAINTENANCE

WARREN PUMPS

. . . ON SERVICES OF THE HEAVIEST CHARACTER AND MOST EXACTING TYPE

For example, take the pair of Warren Duplex Hydraulic Pumps, 12 x 2½ x 12 shown in the accompanying photograph. One was installed in 1916 and the other in 1924 and are used on accumulators up to 2500 lbs. pressure per square inch. These pressures operate hydraulic presses for the final squeeze on various well known rubber products manufactured by Hood Rubber Company.

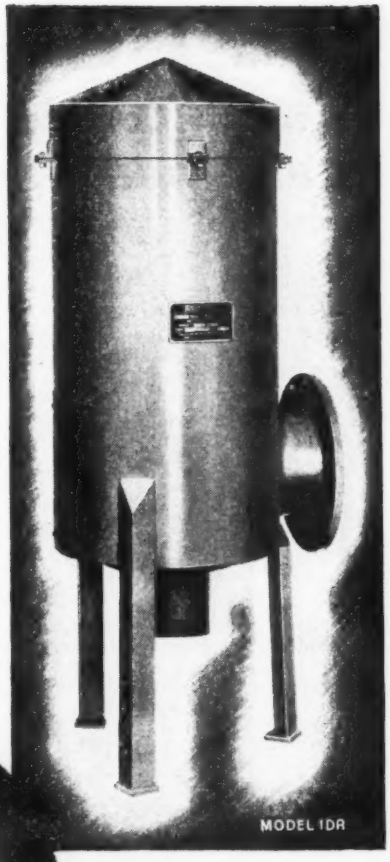
Year after year these Warren hydraulic installations have operated at a high degree of efficiency and with very low maintenance cost. This goes also for other Warren hydraulic installations at Hood, the first of which dates back to 1911.

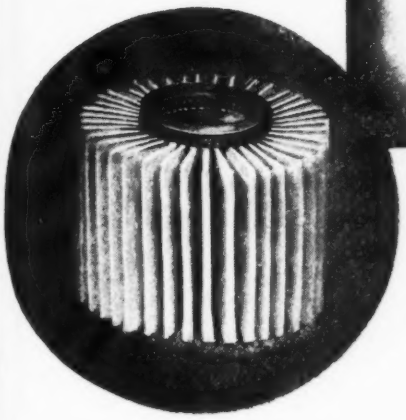
FOR LONGER LIFE AND GREATER DEPENDABILITY

WARREN STEAM PUMP CO., INC.

WARREN, MASSACHUSETTS

new STAYNEW Intake Air Filter





EXCLUSIVE RADIAL FIN CONSTRUCTION PROVIDES:

- ★ More Filtering Area
- ★ Greater Efficiency
- ★ Less Resistance
- ★ Less Frequent Servicing

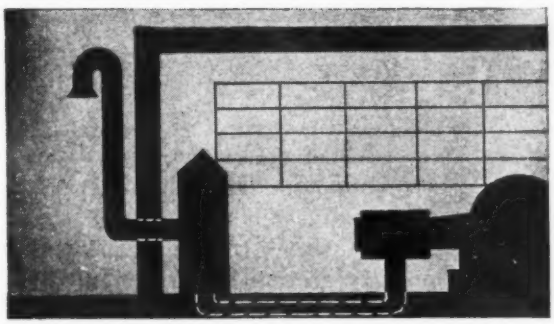
ALL THE CONVENIENCE OF GROUND LEVEL INSTALLATION

ALL THE EFFICIENCY OF HIGH LEVEL AIR INTAKE

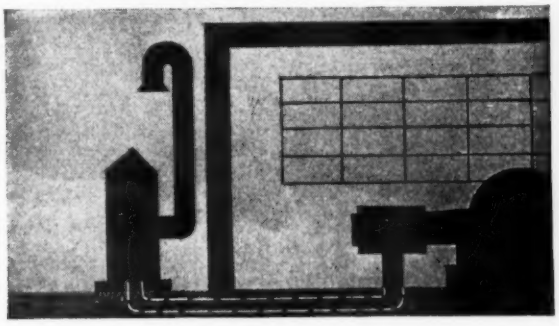
NOW you can equip compressors and internal combustion engines with a Staynew filter providing all the recognized advantages of the famous Protectomotor line . . . *plus* an exclusive combination of two new features.

The new filter, Staynew Model IDR, or IDRS (Silencer), is so constructed that *installation and servicing can be effected at ground level* (right in the engine room itself if preferred), and the *actual air intake located at the most suitable point.*

Models available with solid base for installation when compressor or engine intake is below floor level.



Model IDR INSIDE Engine Room



Model IDR OUTSIDE Engine Room

Engineering Data on request STAYNEW PROTECTOMOTOR FILTERS Representatives in Principal Cities

DOLLINGER CORPORATION

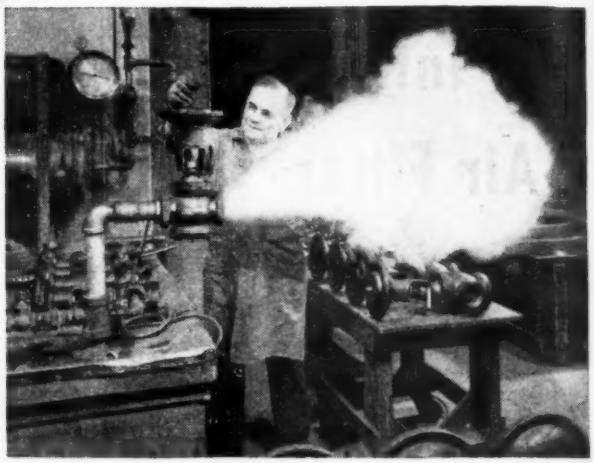
(Formerly Staynew Filter Corporation)

23 Centre Pk.

Rochester 4, N. Y.

WIDE THROTTLING RANGE

Because JOHNSON Control VALVES *are Streamlined Inside*



Testing valves with live steam. Johnson "Streamline" Valves . . . for steam, liquids, air or gas, operating against pressures up to 250 pounds . . . are subjected to many rigid tests before leaving the factory.

"Wide Throttling Range," between tightly closed and fully open valve positions, is a *must* for successful automatic temperature control valves. That is why Johnson Control Valves are ideal wherever close, *g-r-a-d-u-a-l* control of temperatures is required. Many types of valves deliver 80 or 90 per cent of their capacity when barely "cracked open." Johnson Control Valves, on the other hand, deliver considerably less than 50 per cent of their fully open capacity even when opened as far as halfway. There's plenty of "throttling range" left for the final 50 per cent of opening.

Johnson Control Valves . . . for direct action (normally open) or reverse action (normally closed) . . . produce "streamlined" flow characteristics. The modulating plug (or v-port skirt for the higher pressure ranges), instead of the ordinary flat disc, is sure to provide gradual control that IS *g-r-a-d-u-a-l*. An optional feature is the Johnson "Pilot Positioner" for smooth, gradual operation, independent of friction and pressure variations. Johnson "Streamline" Valves, controlled by Johnson "Adjustable Sensitivity" Controllers, provide the best possible in *Gradual Control*. Write for further details. No obligation, of course.

DESIGN
MANUFACTURE
INSTALLATION
SERVICE

JOHNSON
SERVICE COMPANY
MILWAUKEE 2, WISCONSIN
AUTOMATIC TEMPERATURE AND AIR CONDITIONING CONTROL

CONDOR WHIPCORD ENDLESS BELTS

make a smooth, long-wearing treadmill for your horsepower

Condor Whipcord Endless Belts have been turning in extraordinary performance records—measured in years — on difficult drives — especially where these involve small pulleys and high speed.

The continuous, tension-wound whipcord section provides unequalled flexibility. Bonded in a matrix of heat-dissipating FLEXLASTICS* with a pliable, wear-resisting cover, the belt is pressure-vulcanized into an inseparable unit.

This inseparability is further protected by MANHATTAN'S patented Extensible Tip, which relieves stress on the cover at splices on both pulley and outer sides; thereby prevents separation of spliced ends, and permits higher belt speed over small pulleys.

OTHER MANHATTAN Belts** that can be made endless are Condor Compensated and Condor Standard, Paranite-G.O.P. Oil-Proof, Manhattan Non-Spark.

Write for Bulletins.

*The term FLEXLASTICS is an exclusive MANHATTAN trade mark. Only MANHATTAN can make FLEXLASTICS.

**Condor Belts are now made in the dark, war-time color.

★

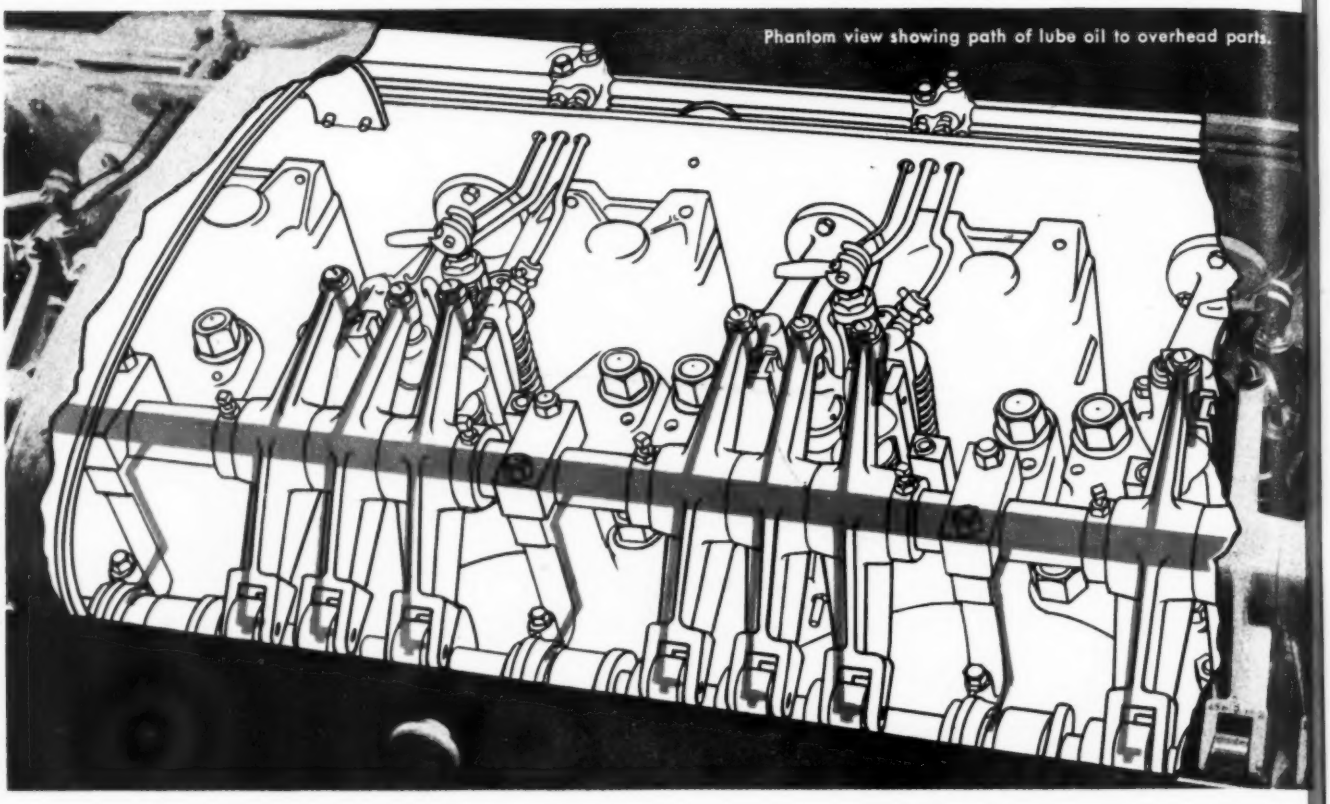
7 CONDOR WHIPCORD ADVANTAGES

1. Low inelastic stretch.
2. Length not variable with atmospheric changes.
3. High degree of bending flexibility.
4. No ply separation.
5. No splice in tension or load-carrying section.
6. Unequalled longevity.
7. Patented Extensible Tip prevents splice separation.

THE MANHATTAN RUBBER MFG. DIVISION

OF RAYBESTOS-MANHATTAN, INC.

Executive Offices and Factories — PASSAIC, NEW JERSEY



Phantom view showing path of lube oil to overhead parts.

NOW LESS TIME OUT FOR SERVICING

Hendy Diesels are *completely pressure-lubricated*

You don't need to hand-lubricate any part of a Hendy Series 50 Diesel. Complete enclosure of the engine enables full pressure lubrication throughout the entire engine of *all* wearing surfaces and parts.

All overhead parts such as camshaft, rocker arms, valve crossheads, guides, and valve stems receive a constant supply of clean oil from the pressure lubricating system. Because of this feature, the time required for routine servicing is reduced. And, what is even more important, correct lubrication of all parts at all times is automatically assured.

Full pressure lubrication is just one of 22 proved design features you'll like in the Hendy Series 50 Diesel. Some other are . . . fresh-water cooling, unit-type fuel injectors, dual intake and exhaust valves, and hydraulic tappets.

Here's why it was possible to incorporate so many modern features in the Series 50 Diesel: Hendy engineers were under no obligation to salvage either parts or tooling from outmoded models when the Series 50 was designed. They were free to use all modern features—all advancements in engineering or metallurgy—that had been proved thoroughly dependable. As a result, the Series 50 is a Diesel engine modern in design, dependable in operation, and low in maintenance and operating costs.

Hendy Series 50 Diesels, 350 to 675 hp, are available as direct-reversing main-propulsion units and, with Crocker-Wheeler generators, as power units for vessels with electric drive or as auxiliary power plants.

Send today for your copy of the new illustrated booklet that contains full information on this thoroughly tested new Diesel.

JOSHUA HENDY IRON WORKS
ESTABLISHED 1856
SUNNYVALE, CALIFORNIA

82-D-13-M

Branch Offices: BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DETROIT • LOS ANGELES • NEW YORK • PHILADELPHIA • PITTSBURGH • SAN FRANCISCO • WASHINGTON

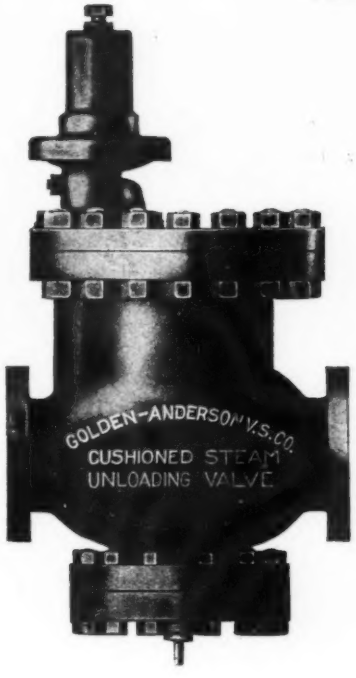
TURBO GENERATORS

STEAM TURBINES

REDUCTION GEARS

DIESEL ENGINES

Maintain Pressure Regardless of Varying Flow Requirements!



Specify the GOLDEN-ANDERSON Steam Pressure Reducing Valve!

This is the valve you need to sensitively maintain downstream pressure under varying flow requirements. Features that make this possible include balanced pilot valve operation and a single seated main valve to prevent downstream pressure from building up under "no-service" operation.

Heavy duty construction eliminates any possibility of distortion from pipe line strain. This type unit is regularly supplied in Base Types or Globe Type Pilot Control. The Globe design permits mounting away from main valve. Valve trim may be Bronze, Monel, Stainless Steel or Gallavoy, according to individual plant requirements. Seat ring and disc may be Stellited. Ten sizes are available, from 2″ to 14″, to handle working pressures from 250 to 600 lbs.

Write for your copy of our latest catalog. It contains complete information on all G-A Specialty Valves, including detailed construction and operation data.

GOLDEN-ANDERSON VALVE SPECIALTY CO.

Manufacturers of Special Valves for Every Need

Fulton Building **Pittsburgh, Penna.**

FOR EXTRA HEAVY SERVICE!

WHEN THE PRESSURE IS ON, packing for valves, pistons, hydraulic cylinders, steam hammers, and other heavy-duty equipment has to have special strength.

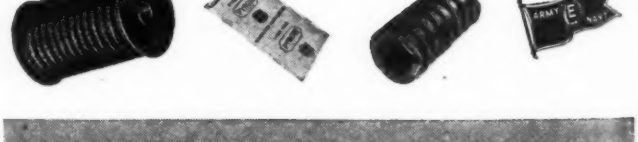
R/M makes thirteen different types of heavy-duty packing, either woven of metal, or reinforced with wire or metal tubes for pressures up to 5,000 pounds.

More than forty years of successful experience in such applications have led to the design of these packings and to the choice of materials used.

And each different type comes in a number of sizes to fit every type of standard equipment.

Whatever your packing need, there is an R/M packing specially designed to fit it. Ask for R/M at your distributor's.

It's "Packed with Satisfaction"—When You Use R/M



INDUSTRIAL SALES DIVISION

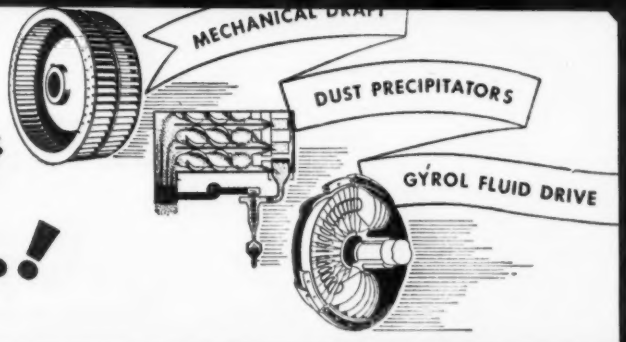
RAYBESTOS-MANHATTAN

INCORPORATED

Manheim, Penna. • Bridgeport, Conn.
North Charleston, S.C. • Passaic, N.J.

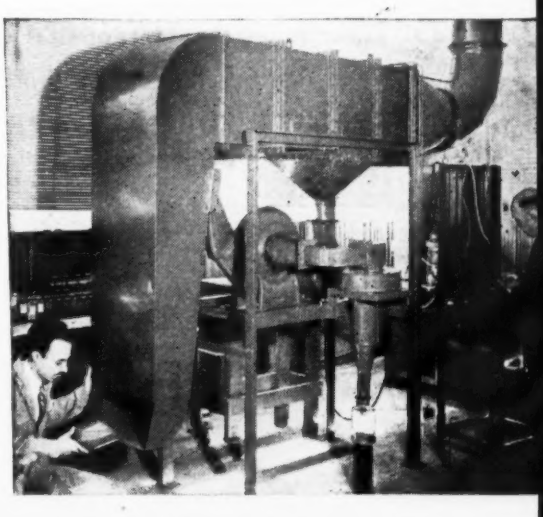
undivided responsibility

Buy all 3 from A.B.C.!



Whether you're planning a new power plant or going to modernize your present one, you can get undivided responsibility by buying all 3—Mechanical Draft Fans, Dust Precipitators, and Gyrol Fluid Drives—from American Blower. By securing all 3 from A.B.C., you have one source of technical information and far less red tape. Try it! Call in an American Blower representative.

ND YOUR FLY ASH PROBLEMS TO HEADQUARTERS. We will run tests, deter- ine the equipment best suited to your individual needs, and work ith your engineers in the application of time-proved American Blower ust Precipitators to your plant or problem. A part of our Dust Labora- y, one of the largest and finest in the industry, is shown on right. ere, in the last 20 years, we have run tests on more than 4100 distinctly fferent materials. Every Dust Precipitator and Dust Collector we sell built entirely in our own plants. Your inquiries are invited. Phone write the nearest American Blower Branch Office today.



AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary corporation

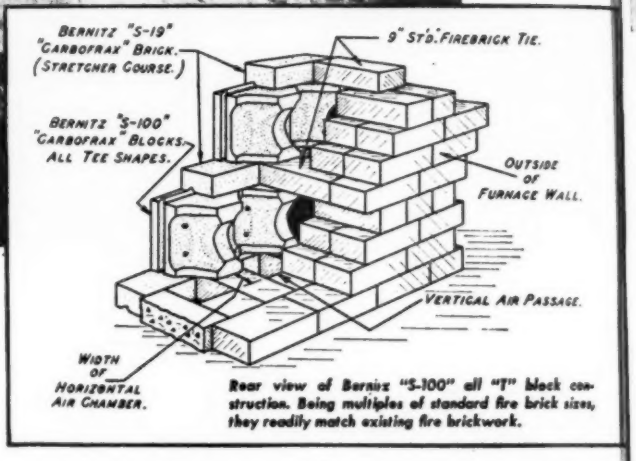
THE PROBLEM:

How to Simplify Small Boiler Maintenance

THE ANSWER:

BERNITZ "*Clinker-free*" SUPER BLOCKS

Bridgewall of single retort furnace—frequently inaccessible for cleaning.


BERNITZ "S-19" "CARBOFRAX" BRICK. (STRETCHER COURSE.)
9" STD. FIREBRICK TIE.
BERNITZ "S-100" "CARBOFRAX" BLOCKS. ALL TEE SHAPES.
OUTSIDE OF FURNACE WALL.
VERTICAL AIR PASSAGE.
WIDTH OF HORIZONTAL AIR CHAMBER.

Rear view of Bernitz "S-100" all "T" block construction. Being multiples of standard fire brick sizes, they readily match existing fire brickwork.

THE smaller stoker fired plant has the same furnace problems that beset the larger plant—perhaps to a greater degree.

The small plant may not have the advantages of automatic combustion control, water-cooled furnaces, or continuous ash discharging stokers. In this type of plant, labor is an important factor in the smooth and efficient operation of steam generating equipment. The more labor, the less time for attention to the job of burning coal efficiently.

BERNITZ SUPER BLOCKS are doing an outstanding job in hundreds of small plants—dairies, laundries, canneries, chemical plants, hospitals, and institutions of all kinds; in fact, in plants of all types where coal is burned, on stokers, and even on hand-fired grates.

BERNITZ AIR-COOLED SUPER BLOCKS keep the walls free of clinkers. "Carbofrax",* the silicon carbide refractory of which these super blocks are made, resists clinker adhesion. There is no penetration. The heavy labor of prying clinker away from the brickwork opposite the dumps is ended. Destruction of the brickwork at this point by bars is prevented, thus reducing maintenance.

Furthermore, the cleaning of fires is quickly accomplished, usually without loss of boiler capacity or time. Ask us to tell you about some installation near you.

Write for Bulletin B-344

* "Carbofrax" is the registered trade mark of, and indicates manufacture by, the Carborundum Company.

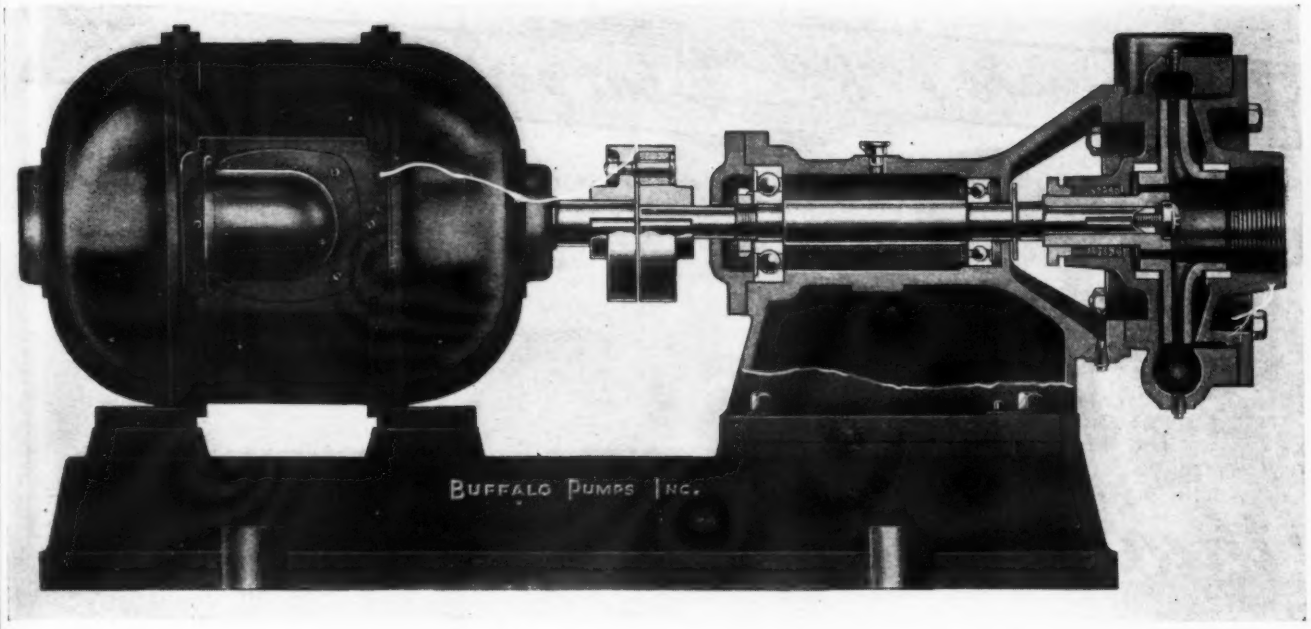
BERNITZ FURNACE APPLIANCE CO. • 89 BROAD ST., BOSTON 10, MASS.

New York Philadelphia Detroit Buffalo Syracuse Atlanta Pittsburgh Cincinnati Chicago Indianapolis Minneapolis St. Louis Cleveland
In Canada: Williams & Wilson, Ltd., Montreal and Toronto

BERNITZ
SUPER BLOCKS

OTHER PRODUCTS INCLUDE:

- BERNITZ FURNACE LININGS
- BERNITZ NYGAARD WATER WALL BLOCKS FOR WALLS AND ARCHES
- BERNITZ AIR-COOLED FLOORS
- BERNITZ SUPERGENERATOR LININGS FOR WATER GAS SETS



Durable—for practical operating men—

The men who are responsible for uninterrupted plant operation are generally skeptics. They take all performance promises with a grain of salt,—only the actual performance records influence them.

For such practical operating men, we build Buffalo Single Suction Full Ball Bearing Pumps. Available with open or enclosed impellers, these husky, oversize pumps are suitable for construction in iron, bronze, stainless steel, nickel, Hastelloy "B" and "C" and most other machinable alloys. (Not in lead.)

Stuffing box design permits modification to suit application; water seal and mechanical rotary stuffing box seals are available. Shaft is oversize and protected by removable shaft sleeve. Oversize ball bearings, properly spaced, provide rigid support for shaft. Bearings run in oil and are protected from foreign material by built-in labyrinth seals.

We could go on, if space permitted, with construction details which would convince you that these pumps "have what it takes". If you are interested, however, why not send for our bulletin 976-B which gives complete details and ratings?

ARMY E NAVY

BUFFALO PUMPS, INC.

488 BROADWAY · BUFFALO, N. Y.

Canadian Pumps, Ltd., Kitchener, Ont.

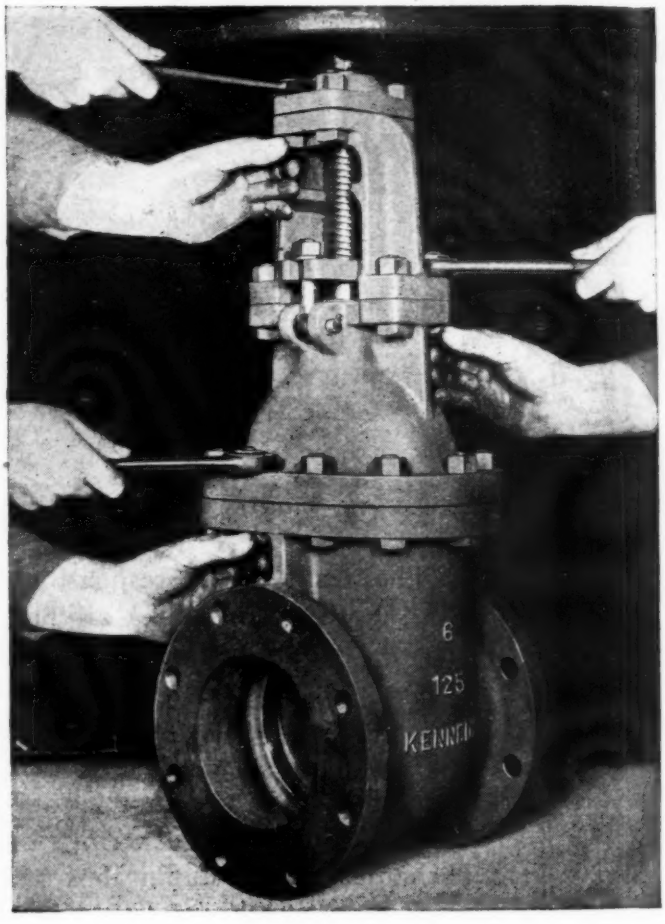
"Buffalo"

Single Suction Full Ball Bearing Pumps

"Trifles make perfection but perfection is no trifle"

One of a series of advertisements explaining how Kennedy gives careful attention to the details of valve design, construction and workmanship that provide maximum effectiveness, convenience, and length of service.

NUTS and BOLTS *that never balk*



Rust-proofed gland bolts and nuts to prevent corrosion . . . all bolts with nuts on top of flanges for convenience . . . all nuts accessible to open-end wrenches . . . slotted stuffing box bolts that swing out of the way for repacking, with washer-type nuts that prevent loss of washers . . . these are some of the reasons why you never need fear balky nuts and bolts on this Kennedy Standard Iron Body Wedge Gate Valve.

Small items? Not to the engineer who has experienced the many little annoyances that are sometimes encountered in handling valves and who wants the best for his money. Moreover, these details typify the care and attention given to every part, large or small, of Kennedy "Extra Value" Valves—obtainable at no extra cost to you.

THE KENNEDY VALVE MFG. CO.

ELMIRA • NEW YORK

KENNEDY *valves . . . pipe fittings . . . fire hydrants*

Another Diesel makes a fine operating record with GULF PARVIS OIL!

Actual photo of a Gulf Service Engineer (left) consulting with power plant Superintendent on Diesel engine lubrication.

"Good lubrication has helped us steer clear of trouble of any kind, and lubricant consumption is very low,"

says this power plant Superintendent.

LUBRICATED with Gulf Parvis Oil, our two older Diesels have made an outstanding efficiency record over a period of many years," says this power plant Superintendent. "So we put this proven top quality oil in service in this newer unit—and we are getting the same efficient operation: no repairs, no stuck rings, and exceptionally low lubricant consumption."

Gulf Parvis Oil is writing a list of definite benefits in the operating records of hundreds of large stationary and marine Diesels. This "dividend" list includes less wear, fewer shutdowns for repairs, lower maintenance costs, and better all-around performance.

Gulf Parvis Oil has superior lubricating value and longer life—two important assets that insure a better protection job under today's peak load operating conditions.

Call in a Gulf Service Engineer today and ask him to recommend the proper grade of Gulf Parvis Oil to fit your particular requirements. Write, wire, or phone your nearest Gulf office.

GULF INDUSTRIAL LUBRICATION

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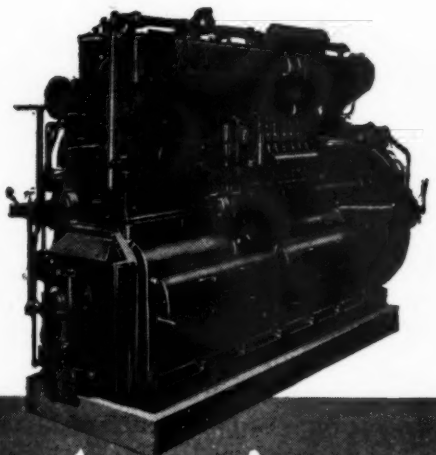
PIPE-LINE EXPRESS!

A pipe line, stretching for a thousand miles. Inside, a column of oil that must keep moving. Pumping stations from point to point. ALCO Diesel Engines, to drive the pumps, meet this vital need for supremely dependable power.

Through pipe lines, ALCO Diesel Engines pump rivers of petroleum and petroleum products to refineries and ports.

ALCO Diesel Engines are light-weight, heavy-duty, compact power units built for every job where quick, adequate, dependable power is needed. ALCO pioneered this new, better type of Diesel Engine. More than 1,500,000 horsepower of ALCO Diesel Engines are in service for innumerable applications —marine, stationary and mobile.

All we can build are now needed for war work. But soon, we hope, ALCO Diesel Engines, including new important features, will be available to give *you* quick power, efficient power, with maximum space economy and minimum unit weight.



American Locomotive

ALCO DIESEL ENGINES

For Universal Application

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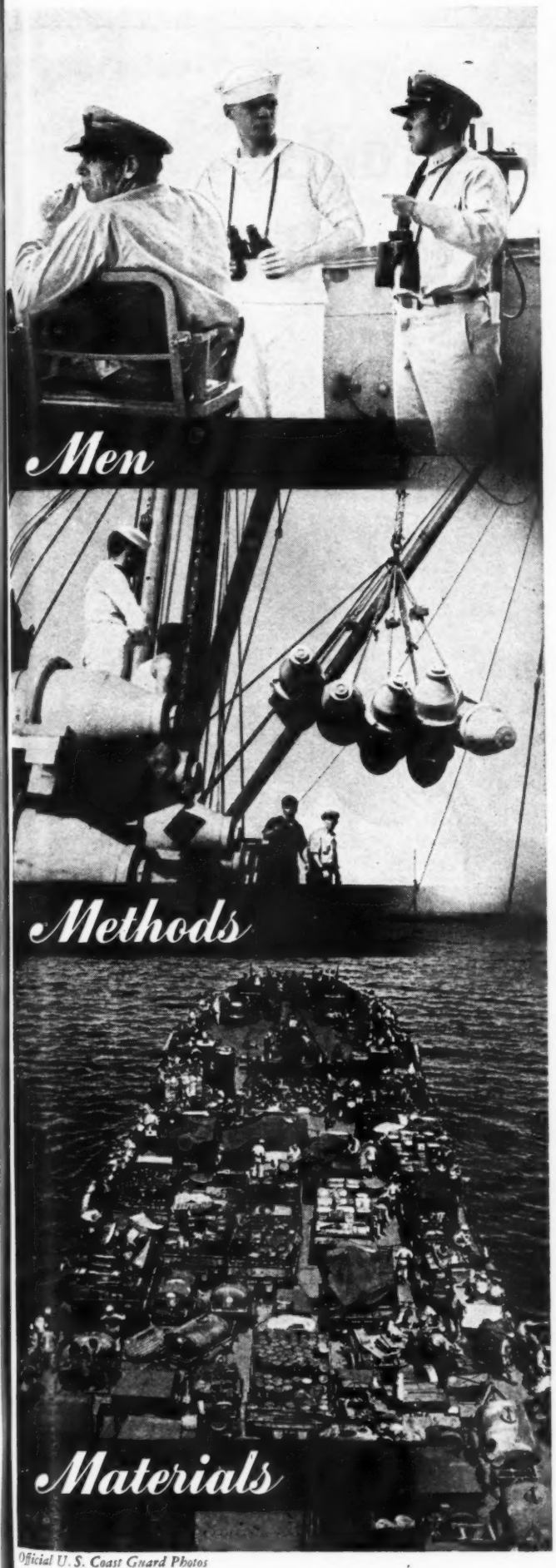

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← LOGISTICS THAT AMAZED THE WORLD!

Logistics is the science of supply—the uninterrupted flow of troops and materials—wherever and whenever needed. The colossal logistic problems of our nation engaged in global warfare can only be solved by the best use of all we have—American manpower, American brainpower, American resources. *Men . . . Methods . . . Materials* . . . the combination that means final victory!

You get insulation efficiency the same way

All the elements *properly coordinated*—men, methods and materials. This is the RUBEROID way to assure maximum service from industrial insulation.

MEN . . . The right men are all-important. Skilled mechanics in the nationwide organization of Ruberoid Approved Applicators handle the jobs. These men know their business. They've licked the most difficult insulation problems.

METHODS . . . Each installation is "tailor-made" to meet the individual job. Ruberoid engineers are not wedded to any one method. You get the benefit of broad experience with all possible methods of application.

MATERIALS . . . The right insulation material to meet your specific temperature control problem. The Ruberoid insulation line has no "gaps" in it from 0° to 1900° F.

Write for Ruberoid Insulation Guide and technical data.
The RUBEROID Co., *Executive Offices*, 500 Fifth Ave., New York 18, N. Y.
ASPHALT AND ASBESTOS BUILDING MATERIALS

How Rutland Profits with Bowser EXACT Liquid Control

Right Down to the EXACT Spoonful

When a single type of equipment serves a manufacturer in many different ways, that's a definite plus.

Take, for instance, the Bowser Meters in the plant of the Rutland Fire Clay Company, Rutland, Vermont, nationally known makers of heat resisting specialties. First, Bowser Meters measure incoming solvent—an obviously important check-up. Then, they measure—right down to the exact spoonful—the liquids going into Rutland products.

And in both operations, Bowser Meters paid off handsomely in these ways:

Uniformity of Product—Human error is eliminated.

Money-saving—A Bowser Meter on the intake line stopped discrepancies and resulting losses.

Time and Labor Saving—An operator sets the Bowser Predetermining Meter for the amount needed for a mix . . . then goes about other work. Time and labor is saved! Production steps up!

You've read about the job that Bowser equipment is doing in the plant of the Rutland Fire Clay Company. This is just one type of Bowser Liquid Control System available today. In the Power industry Bowser turbine oil conditioners, filters and force feed lubricators, etc. are performing similar outstanding jobs. Bowser Pressure Filters, for example, are daily demonstrating their ability to keep oil clean and efficient much longer. Thus they save money by prolonging the life of the equipment and by making the oil work longer. For full details, write to BOWSER, INC., Dept. 2-D, Fort Wayne 2, Indiana.

Not only has Bowser's war production earned the Army-Navy E . . . Bowser equipment has helped earn it for scores of other companies.

BOWSER

SINCE 1885

THE NAME THAT MEANS EXACT CONTROL OF LIQUIDS

"Certainly we're ready to talk elevators"...

DURING the past several years, the manufacturing facilities of the Otis Elevator Company have been devoted largely to the production of a great volume of specially designed elevators and precision equipment for a number of vital war requirements.

And, as long as the war lasts, a large part of these facilities will continue to be devoted to the production of war goods.

Right now, however, the Otis Elevator Company is in a position to help you *plan for your post-war elevator needs.*

Your Otis representative is ready to serve you. He is available to analyze fully your elevator problems and to make recommendations concerning the equipment which will be best suited to your post-war requirements.

By planning now, you will be assured that a minimum of time will be lost in getting your required equipment in production after war restrictions have been removed.

So, to be certain of the last word in vertical transportation for present or proposed office buildings . . . for hospitals, hotels, factories, or warehouses, call your Otis representative *today.*

Otis ELEVATOR COMPANY
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COTTRELL PROCESS

of

ELECTRICAL PRECIPITATION

universally recognized as a
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DUST, FLY ASH, FUME, MIST & FOG

***from* GASES**

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30 years of research, development and operating experience throughout the world are incorporated in the

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New! A BOILER RATIO METER by COCHRANE

A Red indication pointer operating across a white 10" scale makes it unnecessary to examine closely the position of the pens to determine whether the air is excessive or insufficient, for the movement of the pointer is 3 times as great as the difference between the pens.

THE Cochrane Corporation offers to the power plant field a new boiler meter of the steam-flow, air-flow type known as the Cochrane Boiler Ratio Meter. This meter has several important advantages over other constructions. An easily adjustable cam in the air flow mechanism permits the operator to establish the relation of air supply to fuel supply (measured by steam generated) most favorable for his particular operation. The ratio indicating pointer, illustrated and described above, is another feature. The steam flow mechanism is the well-known Cochrane Friction-Free Electric Flow Meter, operating on the null balance principle assuring highest accuracy, while the air flow mechanism is based on the highly responsive Hays slack diaphragm, equipped with an electric motor follow-up for ample power. Intelligent use of the Cochrane Boiler Ratio Meter will result in lower operation and maintenance costs as well as greater plant capacity without increasing the size of the steam producing units or auxiliaries.

Write NOW for a copy of Publication 4071, "Double-Barreled Combustion Guidance"

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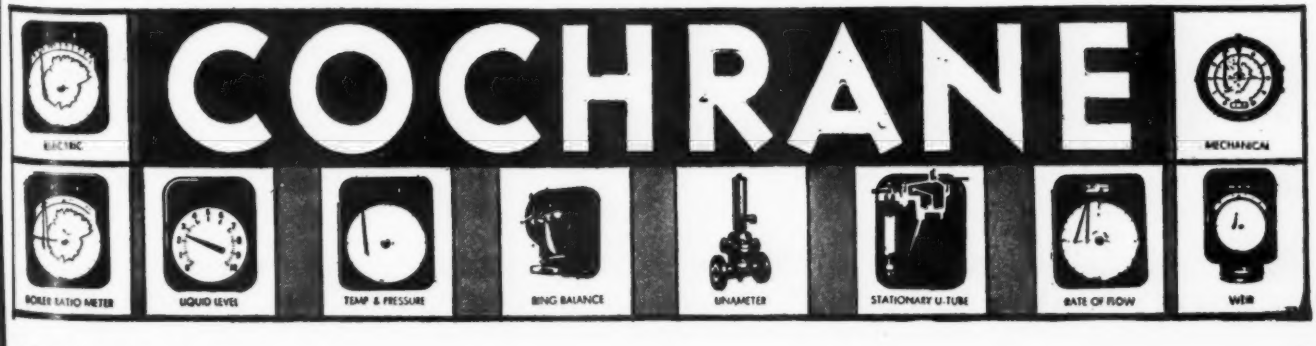
COCHRANE CORPORATION
3106 N. 17th St., PHILADELPHIA 32, PA.

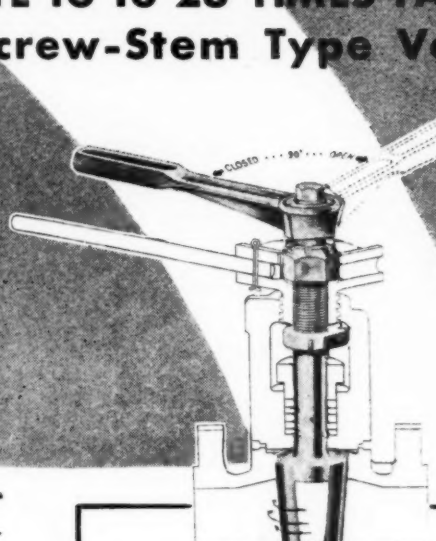
THE MOST COMPLETE LINE OF FLOW MEASURING INSTRUMENTS



Quick Action Every Time

with Homestead Lever-Seald Valves

OPERATE 16 to 28 TIMES FASTER Than Screw-Stem Type Valves



Operation of HOMESTEAD LEVER-SEALD VALVES is quick and positive. From wide-open to fully-closed requires only a *quarter-turn* of the upper lever—and that's 16 to 28 times faster operation than the 6 to 7 full turns required by screw-stem-type valves. Not only do HOMESTEAD LEVER-SEALD VALVES operate quickly, but they are built to operate under all conditions; for built right into every valve is a powerful lever and screw device which relieves seating pressure between the plug and body just enough to overcome friction and permit easy turning. For fast, positive, labor-saving operation, they can't be beat! And the small space required by the Quarter-Turn, permits their use where other valves could not be operated.

HOMESTEAD LEVER-SEALD VALVES are made in combinations of metals and alloys to meet your service requirements, in sizes 1¼" to 10", for pressure ranges from 150 pounds to 1500 pounds. Special valves may be designed to meet your specific requirements. Write *now* for Valve Reference Book No. 38.

6 Reasons

Why You Should Use Homestead LEVER-SEALD VALVES:

1. **Instant Stick-proof operation.**
2. **QUARTER-TURN FULLY OPENS OR CLOSES.**
3. **Positive seal without lubrication.**
4. **Seating surfaces always protected in both open and closed positions. Corrosion practically eliminated.**
5. **Unobstructed straight-line fluid flow.**
6. **All operating parts protected from damaging effects of service conditions and weather.**

Homestead LEVER-SEALD VALVES

"M" Pennant with three additional gold stars—highest Maritime production award yet given to the men and women of any manufacturing company.

HOMESTEAD VALVE MFG. CO. · · · P. O. BOX 210 · · · CORAOPOLIS, PA.

COPPER ALLOY BULLETIN

MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company — "Bridgeport" BRASS CO. — *Headquarters for BRASS, BRONZE, and COPPER*

The Influence of pH on the Corrosion Rate

The term pH (hydrogen ion concentration) has come to us from the biologist who knows that life processes of all types of organisms are markedly influenced by the hydrogen ion concentration present in the solutions which surround them. Since certain species of organisms can survive in only very narrow range limits of hydrogen ion concentration the biologist has developed a mathematical formula for expressing the activity of a solution with respect to its hydrogen ion concentration.

For example:

A pH of 14 means that .00000000000001 grams of Hydrogen ions are present in a litre of solution.

A pH of 7 means that .0000001 grams of Hydrogen ions per litre of solution are present.

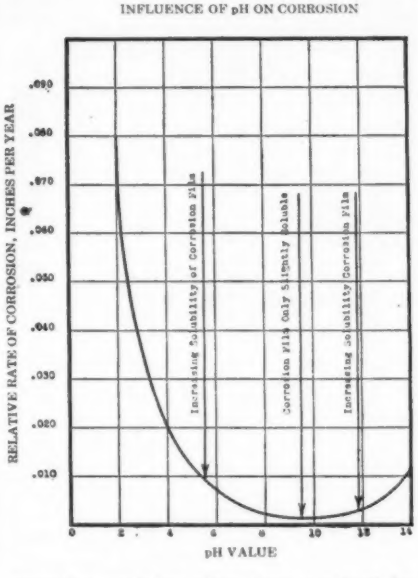
This value is the pH value for pure uncontaminated distilled water at room temperature. pH4 means that .0001 grams of Hydrogen ions are present in 1 litre of liquid. A reduction of several numbers on the pH scale may mean more than a thousand fold increase in Hydrogen ion content with correspondingly greater activity.

The pH factor by itself, does not tell the whole story. The character and quantity of ions other than Hydrogen present in the solution must, of course, also be taken into consideration. In other words, the pH value should be used in conjunction with the chemical analysis of the water or liquid. The presence of various salts such as chlorides, nitrates, sulphates, etc., and gases such as ammonia, hydrogen sulphide, carbon dioxide, etc., are very important in their influence on corrosion.

Since control of operations is an important function of both the power plant and marine engineer, the use of the pH value has become an essential part of his water control analysis. For example, boiler feed water is usually treated before it is fed into the boiler. This is done because a water with the proper composition will be less scale forming and less corrosive than before treatment. As far as steam condensate is concerned, periodic checks on its pH value and composition are helpful and necessary to detect the entrance of harmful impurities that may attack metals.

The approximate curve showing the influence of the pH value of fresh water on corrosion of copper base alloys appears in the chart below. The general shape of this curve may be considered as fairly typical. The flat portion and the slopes of the curve vary with the character of the metal and the nature of the corrosive solution.

The curve shows in a general way what may be expected when a change in pH value takes place. For example, a drop in pH value may indicate a rise in corrosion rate. More specifically, clean sea water normally has a pH value of more than 8.0 whereas harbors, estuaries and bays may have appreciably lower pH values because of contamination from sewage and factory wastes. The higher corrosion rates of harbor waters therefore indicate the need for more



corrosion resisting alloy than required for clean ocean water.

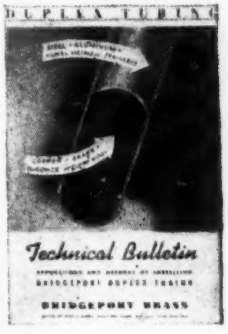
.It must be taken into account that a natural fresh water with a pH value of 7 to 8 usually is much less corrosive than sea water with the same pH value because of the presence of much mineral matter (salts, etc.) found in sea water. It is for this reason that the average life of a condenser tube in a power plant using fresh water is much longer than that of the same alloy with clean sea water. Polluted sea water is considerably more corrosive than clean sea water.

The pH values if checked periodically are an indication of uniformity of water supply. Changes in value should be looked upon with suspicion and investigated. More and more attention is being paid to water analysis since its importance is being more widely realized.

More detailed information on the subject of pH values and corrosion in general are dealt with in Bridgeport's Condenser Tube Manual. Write for your copy if you are planning to retube your condensers or if your tubes are not standing up as long as they should.

Technical Bulletin on Duplex Tubing

Duplex Tubing was developed to overcome corrosion problems too severe for a single metal or alloy. By treating such a condition as two separate corrosion problems, and selecting the material best for each, it is possible to combine two such materials into one tube. Moreover, Bridgeport's method of manufacture produces a close mechanical contact between the two materials without seriously interfering with heat transfer properties.



One of the most important applications described in the bulletin concerns ammonia refrigeration systems with copper for the water side and mild steel for the ammonia side. This combination is standing up much longer than steel pipe, which rusts away. Other combinations described in the bulletin are: Bridgeport Admiralty, Copper, Red Brass, Brass, Cuzinal, Cupro Nickel or Duronze IV combined with such materials as Carbon Steel, Stainless, Aluminum or Monel Metal.

Cross-section drawings illustrate methods of installation for low and high pressures, and for different liquid velocities. The problem of galvanic corrosion between the tube sheet and the tubes is covered, and corrective methods are described.

This Technical Bulletin on Duplex Tubing may be obtained free of charge by writing to Bridgeport Brass Company on company stationery.

Note: Bridgeport products are supplied in accordance with existing priority regulations.

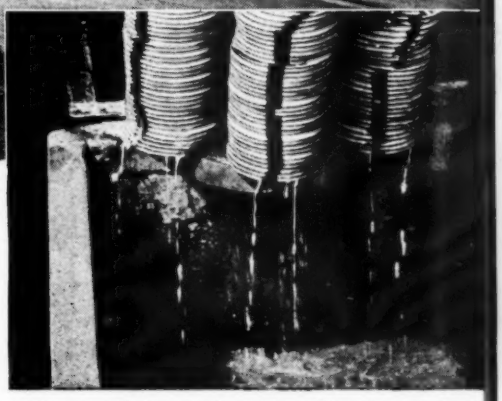
BRIDGEPORT BRASS

BRIDGEPORT BRASS COMPANY, BRIDGEPORT 2, CONN.

ARMY E NAVY

ESTABLISHED 1865

It's what goes on INSIDE that count



Close-up of rings coming out of Silcoating treatment

Inside an engine, Pedrick Silcoating gives extra protection

TAKE NO CHANCES on new rings that may scratch or scuff the cylinders. Pedrick rings are Silcoated to cushion the cylinder walls against damage during the critical wear-in period. They seat quicker with safety.

Pedrick Silcoated rings are also Heat-Shaped for further wear-in protection. This patented process means correct shape, exact tension, and proper flatness, all of which contribute to quicker, safer seating, and longer, economical service.

Today, when aging diesel-driven tractors, trucks, trains, ships, and power equipment must put in hundreds of hours of overtime, Pedrick *precisioneered* piston rings make it possible to lengthen the time between overhauls, and to maintain higher compression and power.

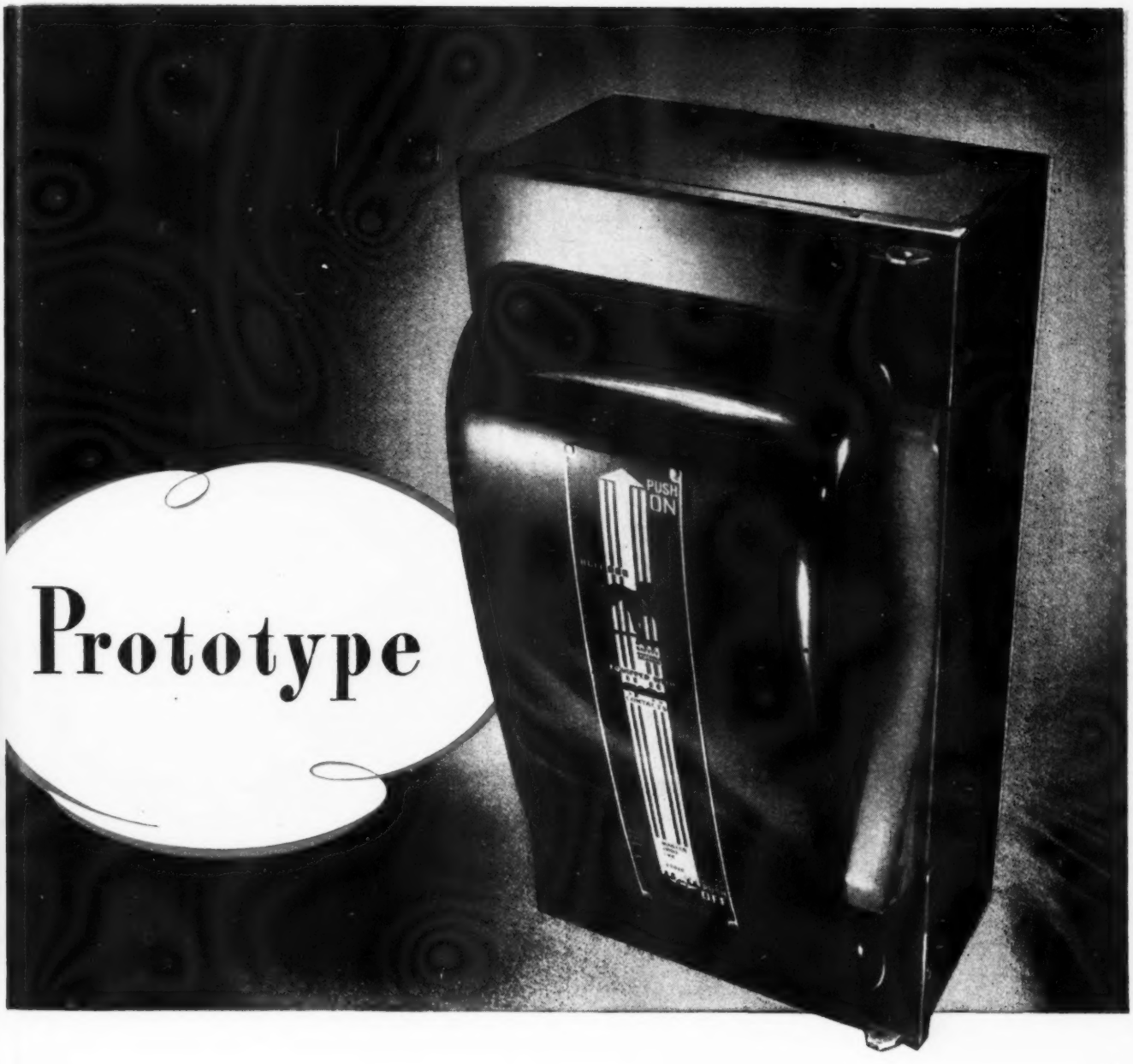
Write for the Pedrick industrial catalog.

WILKENING MANUFACTURING CO., Philadelphia 42, Pa. *In Canada:* Wilkening Manufacturing Co. (Canada), Ltd., Toronto.

NOW THAT YOU'VE *GIVEN* TO THE RED CROSS, *INVEST* IN MORE WAR BONDS

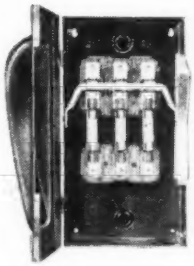
Pedrick

precisioneered PISTON RINGS



Prototype

Vacu-Break SAFETY SWITCH WITH "CLAMPMATIC" CONTACTS



A *Prototype*, the dictionary says, "is an original model after which anything is copied."

Measured by that definition, the BullDog Vacu-Break Safety Switch, with its many advanced features, is definitely the *prototype* of tomorrow's designs.

The exclusive Vacu-Break principle of arc suffocation—the Clampmatic feature which assures contacts tight as a bolted connection—new, simplified operating mechanism—modern streamlined design and attractive appearance—are but a few of tomorrow's safety switch features which are exclusive in the BullDog Vacu-Break Switches of today.

These *prototype* BullDog features are your guarantee against obsolescence, as well as your assurance of top performance at minimum cost right now!

Capacities from 30 Amp. to 1200 Amp. Write for illustrated folder.

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ELECTRIC PRODUCTS COMPANY

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In Canada: BullDog Electric Products, Ltd., Toronto
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Also Manufacturers of

SaftoFuse Panelboards—Switchboards—Circuit Master Breakers — BUStribution Duct, for "plug-in" power — Universal Trol-E-Duct, for flexible lighting—Industrial Trol-E-Duct, for movable "loads."

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Experience and Service will safeguard your boiler system and processes against the damage that can be caused by corrosion, scale, carryover, embrittlement. We offer

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based upon 60 years cumulative experience. Write for our latest booklet on Water Testing Equipment for Power Plants and Methods of Procedure.

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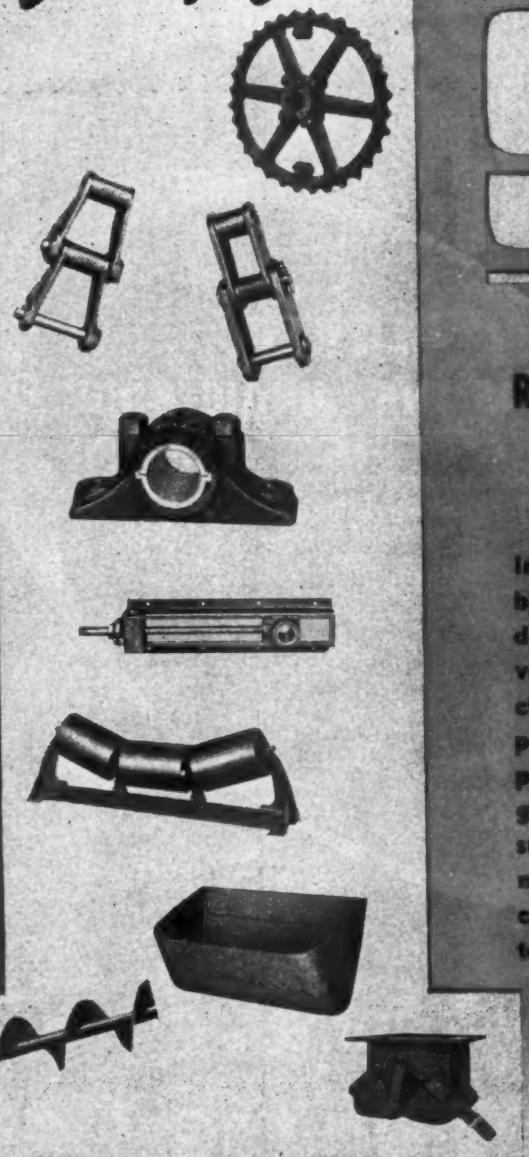

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Insure your plant against frequent breakdowns — prevent costly shutdowns of your elevating and conveying equipment by using Jeffrey chains and genuine replacement parts. They are manufactured to precisely the same standards as govern original equipment. We can supply a wide range of maintenance items—can help you develop complete material handling systems. Investigate.

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HAS THE "KNOW-HOW"

As the pioneer Company in the development and manufacture of silencing equipment, Maxim has experience "plus" to offer in solving your silencing problems. Maxim exhaust and intake silencers, spark arrestors, steam blow-off silencers and the new Heat Recovery silencers are in operation today in industry from coast to coast. When the problem is silencing, consult Maxim.

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...For Stand-out Service

Experience and skill—36 casting-years of it—*plus* the latest in scientific testing and control . . . all are combined at Sivyer to give you higher steel casting quality—for longer, trouble-free service.

Long before a Sivyer casting takes material form—this skill is at work for you . . . in the careful study of pattern design . . . the thorough beforehand planning . . . the engineering.

And when metal is poured, Sivyer's casting methodology—based on this long experience—is there to assure steel castings of greater internal integrity. Later, careful inspections and numerous tests further establish the right of every steel casting to wear the Sivyer diamond ◈ — *the mark well worth looking for.*

SIVYER STEEL CASTING COMPANY
MILWAUKEE CHICAGO

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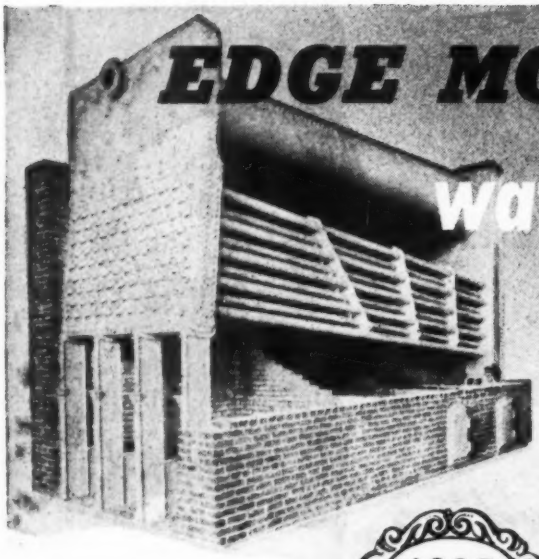
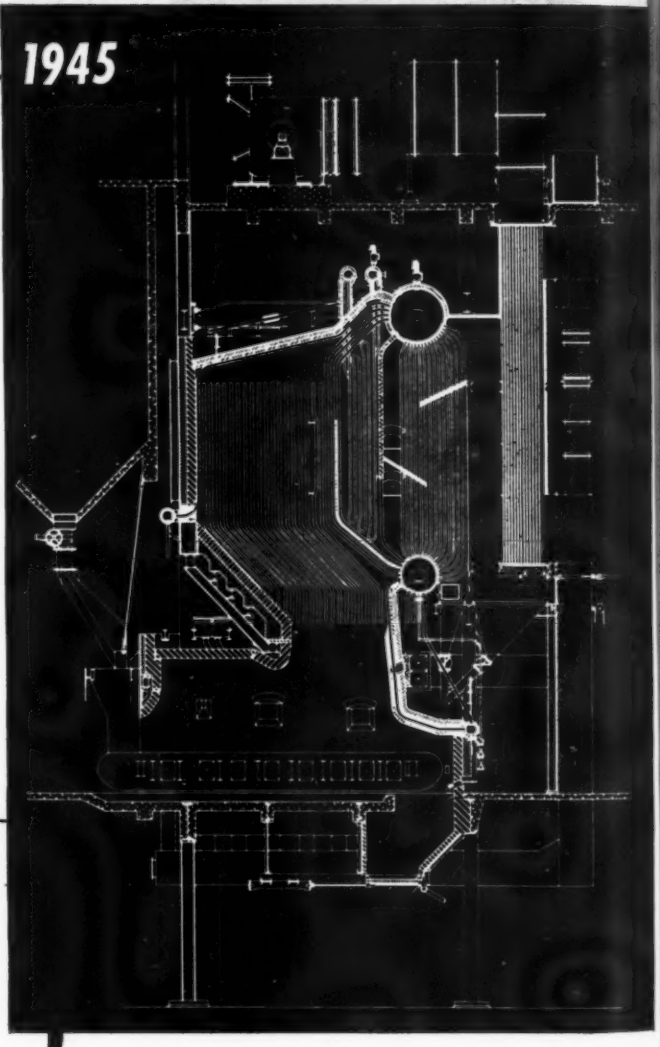
EDGE MOOR water tube boilers



VINTAGE 1895 • THE FIRST EDGE MOOR WATER TUBE BOILER

An Edge Moor Catalog of 1902 states: "This boiler is still in active service, and demonstrates that our boilers were designed on sound principles, and only improvements in details were necessary to make them what they are today."

1895 1945



Edge Moor was established in 1868 and has been building steam generating units for nearly three-quarters of a century. Fifty years ago, in 1895, we began the manufacture of water tube boilers, and followed several years later with the first superheating steam boilers.

Edge Moor engineers have continued to contribute to the store of knowledge and experience gained in the building of steam generating equipment. Today, upwards of 5000 installations attest to the many advances in design, efficiency and standards of quality originated by Edge Moor.

Edge Moor boilers are designed for any required capacity and up to 900 lbs drum pressure. Complete steam generating units, auxiliary equipment and installation service are available—from Edge Moor.

Edge Moor 2-drum bent tube boiler with pendant convection superheater, vertical tubular air preheater, water cooled furnace, travelling grate stoker. Capacity, 75,000 lbs steam per hour; Drum Pressure, 450 psi; Degrees of Superheat, 300; Final Steam Temperature, 750° F.

STEAM GENERATING EQUIPMENT

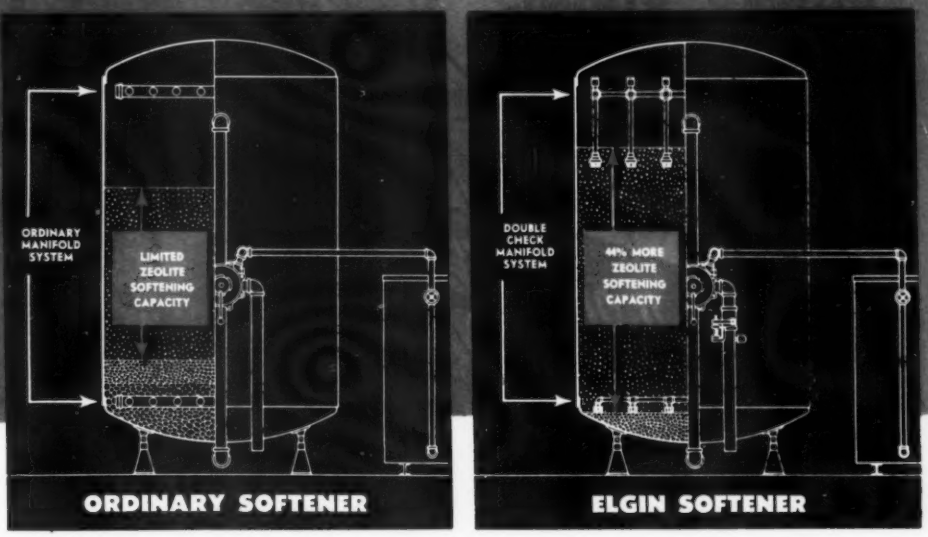
EDGE MOOR IRON WORKS, INC.

BRANCH OFFICES: NEW YORK 20, N. Y.: 30 ROCKEFELLER PLAZA
CHICAGO 2, ILL.: ONE NORTH LA SALLE STREET

MAIN OFFICE AND WORKS: EDGE MOOR, DELAWARE

THIS COMPARISON SHOWS
how Elgin Water Softener gives
44% MORE SOFT WATER

- *Prevents loss of zeolite*
- *Requires less salt*
- *Assures better backwashing*
- *Costs less, capacity considered*



Ingenious "Double-Check" manifold system does it!

THERE is nothing mysterious about the 44% increased soft water output of the new Elgin Zeolite Water Softener. The whole story is told by the two drawings above—at the left, the conventional softener; at the right, the new Elgin.

Tank sizes are the same, but note the far larger zeolite content of the Elgin Softener. Note, also, the totally different Manifold used in the Elgin. This exclusive "Double-Check" design makes the deeper bed possible without loss of zeolite—a loss that the conventional softener attempts to avoid by using a shallow zeolite bed as diagrammed above.

Of course more zeolite means more soft water output, for it's the zeolite that does the job. But the ingenious "Double-Check" Manifold system goes beyond that . . . permits zeolite to be washed cleaner . . prevents packing and channeling of the bed. Thus the brine reaches every portion of the zeolite, producing more efficient regeneration with less salt consumption.

Increase the soft water output of your present water softener with the "DOUBLE CHECK" MANIFOLD SYSTEM

The "Double-Check" Manifold System is adaptable to water softeners of any make. This change, supplemented by remarkable ELGIN HIGH-CAPACITY ZEOLITE will greatly increase soft water output and operating efficiency. The cost of such modernization is surprisingly low

In these high pressure times, most plants have too little soft water. Here is the answer to your need for more soft water, not only for boilers, but for hot water systems, processing, or any other need that may exist.

For facts about the Elgin Softener or modernization of your present water softener, write for Bulletin 603.

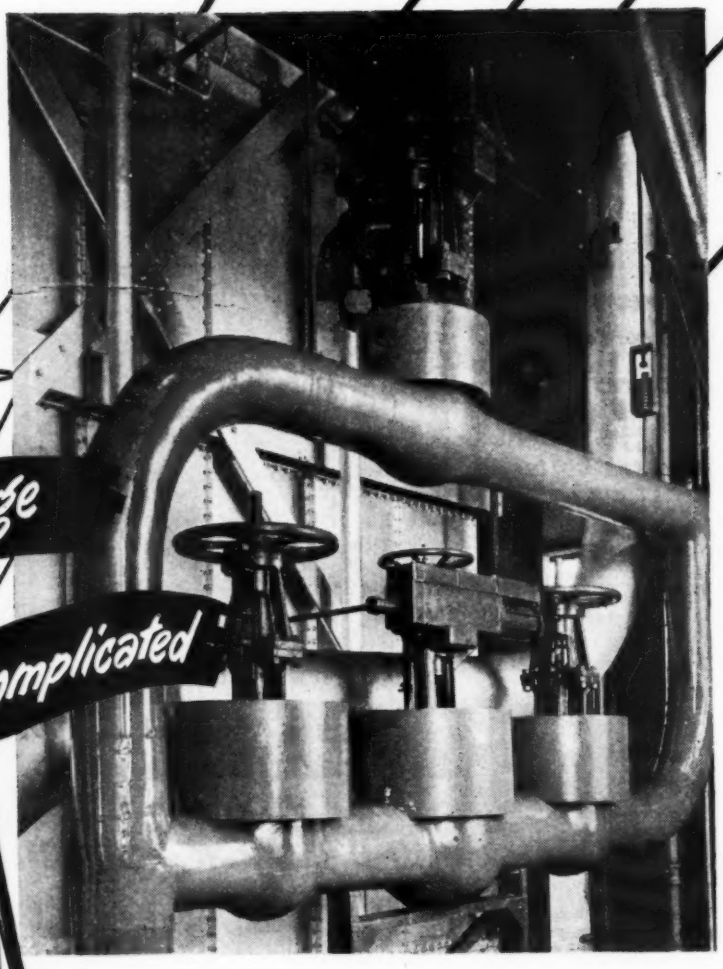
ELGIN SOFTENER CORPORATION, 130 N. Grove Ave., Elgin, Ill.

ELGIN
ECONOMICAL WATER CONDITIONING

WATER CONDITIONING FOR EVERY NEED

Elgin is known for achieving results at lowest possible cost. The complete Elgin line includes: Boiler Water Treating and Purifying Systems • Feedwater Treatment • Deconcentrators • Water Softeners • Filters and Purifiers • Iron Removal Equipment • Aerators • Water Treating Chemicals • Chemical Feeders • Scale and Corrosion Inhibitors • Sample Coolers • Water Testing Equipment • Zeolites

CALL NAVCO on POWER PIPING PROBLEMS



Small or Large

Simple or Complicated

Whatever your Piping problem may be, Navco is in position to help you. The knowledge which we have gained in the past 36 years has not been confined to design and fabrication alone. It includes a wide field of experience in erecting and testing Piping Systems for every Service.

NATIONAL VALVE & MFG. CO.
Pittsburgh 1 **Pennsylvania**

NAVCO

NAVCO PIPING

SATISFYING THE WORLD'S TOUGHEST CUSTOMER

INVISIBLE ARMOR

Around every American vessel in dangerous waters today is a broad band of "invisible armor" – the electrical field of a DeGaussing belt – protecting it against magnetic mines.

These mines took a terrific toll of shipping early in the war. Buried deep in the sea they were difficult to detect and remove. Any ship passing within the magnetic field of a mine detonated it; force of the explosion was sufficient to crumple steel hulls many feet away.

Prompt installation of DeGaussing equipment was the answer to this enemy weapon. Star was called upon to help. Here again the U. S. Navy was a "tough customer" to satisfy – the Bureau of Ships demanded motor-generator sets that established new standards for compactness and ability to resist shocks and strains; called for quick delivery.

While the Navy does not endorse any product, the fact that Star was able to design and build the special equipment for DeGaussing installations, and maintain unfailing delivery schedules, is ample evidence of the high engineering skill of this organization. That engineering skill is available for your use in solving industrial motor problems. Star Electric Motor Company, 200 Bloomfield Avenue, Bloomfield, New Jersey.

Let Us Help Solve Your Special Problems

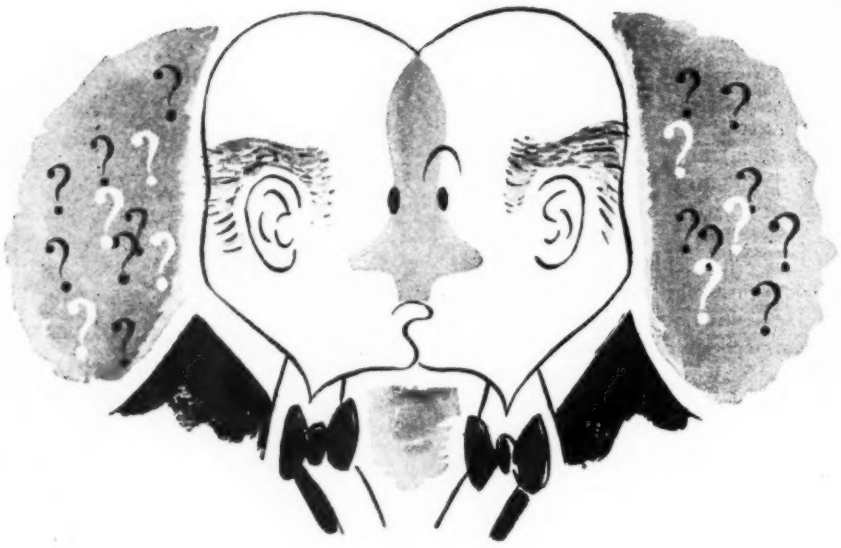
Motor-generator set, above, was designed and built by Star to meet special U. S. Navy requirements on voltage, compactness, resistance to shocks and strains. Occupies only half the space required for comparable sets.

Star's record in designing motors and generators for many Navy needs is proof of our ability to solve your difficult motor problems. A standard Star (⅛ to 200 H.P.) may handle your job; if it doesn't we'll build one that will Discuss your post-war plans with us now.

STAR MOTORS

POWER PACKAGED AS YOU NEED IT

QUICK QUIZ:



Are you asking yourself these questions?

What can I do about errors in measurements of metals due to changing air temperatures?

How can I eliminate airborne dusts that mar metal surfaces?

Can I do anything about perspiring hands that finger-mark metal surfaces?

How can employee efficiency be kept high even on hot, humid days?

What will prevent condensation and resulting corrosion?

How can I maintain a clean, quiet drafting room, free from outside noises and dust?

EASY ANSWER:

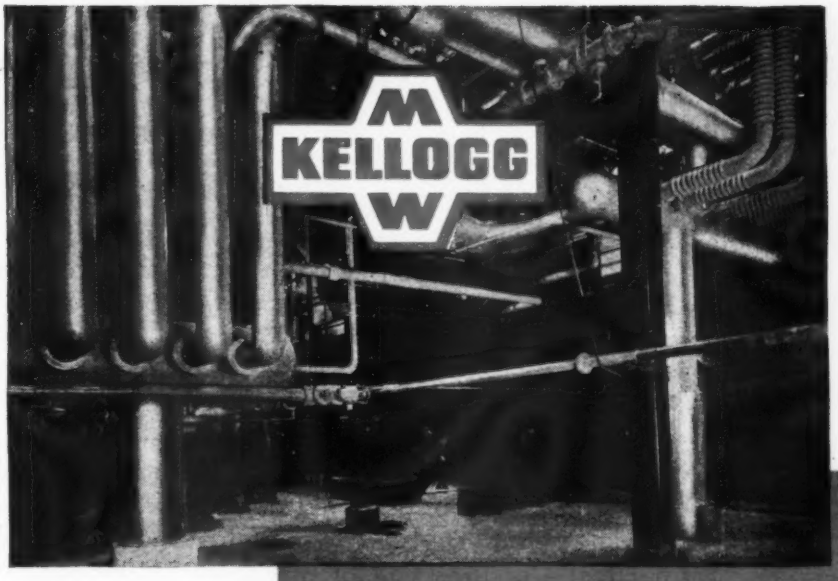
DO AS MANY modern industries have done. Put your problems up to Carrier — air conditioning's most experienced specialists — devoted solely to this field for 43 years. Carrier's wartime accomplishments put at your service the latest, most important developments in modern air conditioning and refrigeration. Consult Carrier on present or postwar requirements.

Carrier Corporation, Syracuse, N. Y.

Carrier

AIR CONDITIONING • REFRIGERATION

INDUSTRIAL HEATING



A Small Army of Specialists Keeps KELLOGG PIPING One Step Ahead in Performance

They work with one object in view; to produce piping which will successfully solve the most complicated design and operating problems.

Chemists, metallurgists, process and mechanical engineers do their part. When extremely complicated designs are encountered, super-sensitive apparatus, perfected by Kellogg for determining moments and forces electrically are put to use. Problems of plant size systems are solved in the laboratories before specifications are prepared.

The benefits of this comprehensive service are available to public utility, consulting, process and marine engineers. On your next difficult piping job, consult a KELLOGG engineer.

THE M. W. KELLOGG COMPANY

225 BROADWAY, NEW YORK 7, N. Y. • **JERSEY CITY, NEW JERSEY**

REPRESENTATIVES

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"Masterflex" Prefabricated Piping Systems • "Masterweld" pressure vessels for Power, Refinery and Chemical Industries. Heat Exchangers. Pyrolytic and Catalytic Cracking Units, Hydroforming, Reforming, Dehydrogenation, Alkylation, Desulphurization. Thermal and Catalytic Polymerization Units • JUIK Processes for Lubricating Oil Plants. Plastic Refractories • Radial Brick Chimneys.

Where conditions of service call for STEEL

. . . in the low pressure range where high temperature, corrosive liquids, fire hazards or need for unusual precaution against leakage or line strains make iron valves impractical—that's where **R-P&C** 150 lb. steel valves and fittings serve best.

READING-PRATT & CADY is especially well-equipped to make these valves, having long specialized on pressure castings of electric furnace steel. Beyond that, **R-P&C** rigid control—from drawing board to final test—assures you of maximum service from every **READING-PRATT & CADY** valve.

The line is extensive, including globes, angles, gates and checks in all the standard pressure classes from 150 lbs. to 1500 lbs.

We suggest that you get a recommendation from **R-P&C** the next time you need valves.

R-P&C offers you a single responsible source for bronze, iron and steel gate, globe, angle and check valves—cocks and lubrotite gate valves—bar stock valves—cast steel fittings—D'Este Automatic Valves and Engineering Specialties.

• Valves illustrated are flanged end. All are available with welding end—most with screwed end.

READING-PRATT & CADY

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READING CAST STEEL VALVES AND FITTINGS • PRATT & CADY BRASS AND IRON VALVES
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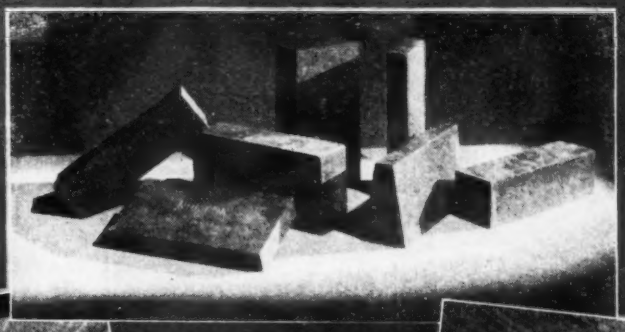
ACCO

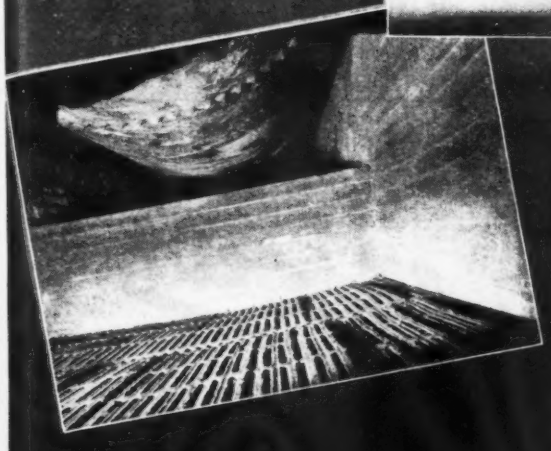
READING-PRATT & CADY DIVISION
AMERICAN CHAIN & CABLE

TRADE MARK

In Business for Your Safety

For Boiler Furnaces and Gas Generators



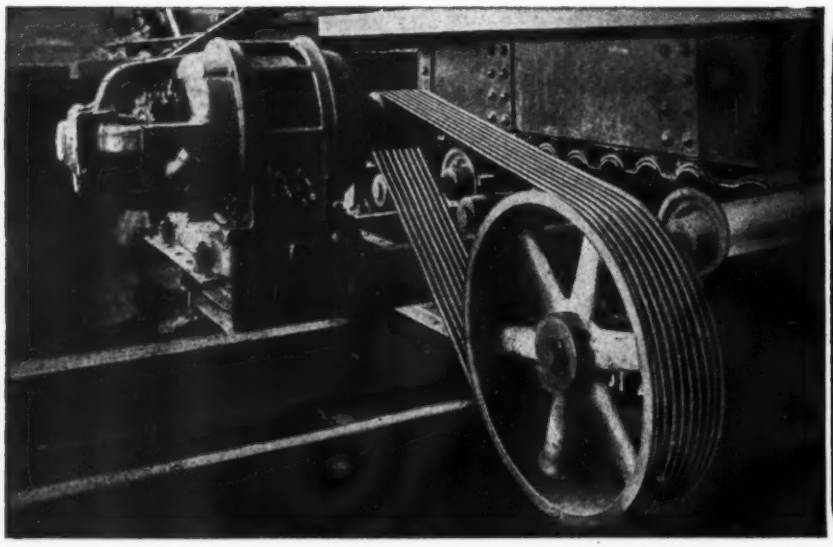


Long-Lasting CRYSTOLON Brick

Crystolon Brick have long proved eminently successful for use in stoker fired boiler furnaces and in the linings of water gas generators. The long-lasting quality of these silicon carbide brick results from their resistance to (1) high temperatures, (2) the corrosive action of coal ash, (3) the penetration of slag. Clinkers will not penetrate the dense surface of crystolon brick and are easily removed, leaving the face of the brick clean and unaffected for further service.

Norton Company, Worcester 6, Mass.

Norton Longer Lasting **Refractories**



GET THE *Time tested buy* IN V-BELT DRIVES

Wood's the LONG LIFE LINE

NEXT TIME BUY Wood's

Buy Wood's drives because, gauged both by built-in quality and reliable performance, they exemplify the outstanding buy in the V-Belt field.

Buy Wood's V-Belt drives because they are *designed* for efficient power transmission. They do the job of turning energy into work—bringing power from its origin to the driven machinery with minimum loss.

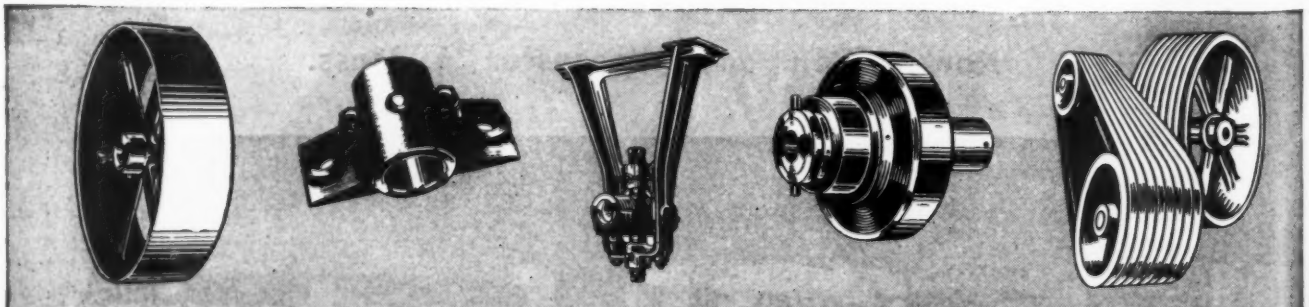
Wood's V-Belt drives render trouble free service ... provide inherent day-in and day-out reliability at a low figure for maintenance.

Wood's products have stood the test of time. Since 1857 this complete line of transmission equipment—with an earned reputation for excellence—skillfully designed and efficiently manufactured, has been a dependable stand-by of industry.

Wood's V-Belt drives and other products of Wood's manufacture, will serve you faithfully in the post war era. Plan for post war now. Engineering consultation welcomed. Details furnished upon request—or see your conveniently located Wood's distributor.

EVERYTHING IN TRANSMISSION

Bearings — Collars — Clutches — Couplings — Contactors — Hangers — Pillow Blocks — Pulleys — V-Belt Sheaves and Complete Drives



T. B. WOOD'S SONS COMPANY, CHAMBERSBURG, PENNA.

Branches: Boston, Mass. Newark, N. J. Pittsburgh, Pa. Cleveland, Ohio Detroit, Mich. Houston, Texas

You are looking at

A CUTAWAY VIEW OF A NEW TREND

in motor design

Two decades ago the purchaser of squirrel-cage motors had but one choice—the open motor. If operating conditions proved too severe, the only answer was to be found in frequent replacements.

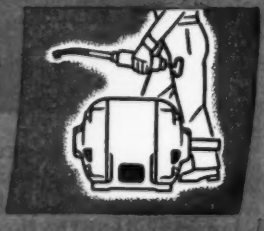
Then came a period of new development in mechanical design, which resulted in the birth of dripproof, splashproof, totally-enclosed, fan-cooled, and a host of other new types, each designed for operation under certain adverse conditions.

But today there is a new trend—represented by Crocker-Wheeler Protected-Type Motors. These motors, besides having the surplus capacity of open designs, provide protection against many of the most common hazards encountered in operation. They may be used for many services for which enclosed and partially-enclosed motors have been specified in the past, *and yet, Protected-Type Motors cost no more than open motors.*

When and Where to Use Protected-Type Motors

WHERE THERE IS DRIPPING LIQUID
Because Protected-Type Motors are dripproof, falling water, oil, or other liquids cannot enter the windings. All ventilating openings are shielded.

WHERE THERE ARE FALLING CHIPS
Protected-Type Motors are ideal for machine tool and similar applications where metal chips and other foreign matter might injure the windings of less well-protected motors.



WHEN INSPECTION VISITS ARE FEW AND FAR BETWEEN
Because rotors are practically indestructible, stator windings are amply insulated, and ball bearings require attention only annually (sleeve bearings are optional), Protected-Type Motors call for minimum maintenance.

FOR ALL GENERAL-PURPOSE APPLICATIONS
Rated 40C rise, full-load continuous duty, with a 15 per cent service factor, these motors are suitable for all general-purpose applications. Mounting dimensions conform to N. E. M. A. standards.

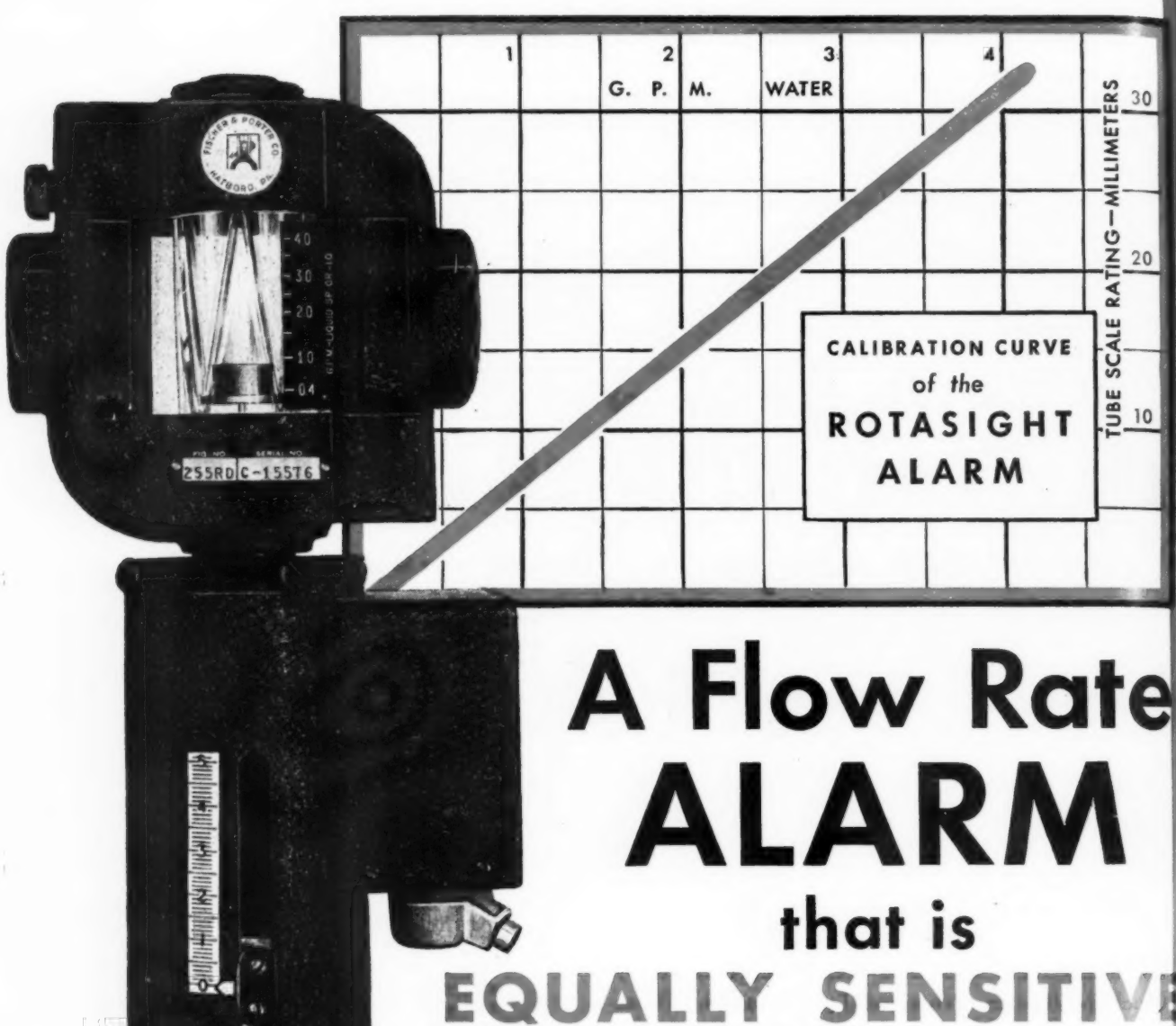
FOR COMPLETE DETAILS, send for your FREE copy of this NEW four-page bulletin. Shows how these motors are protected; why they will give long trouble-free service. Write today — no obligation.

CROCKER-WHEELER

A DIVISION OF JOSHUA HENDY IRON WORKS, AMPERE, NEW JERSEY

Branch Offices: BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DETROIT • LOS ANGELES • NEW YORK • PHILADELPHIA • PITTSBURGH • SAN FRANCISCO • WASHINGTON

SQUIRREL CAGE MOTORS · WOUND ROTOR MOTORS · DIRECT CURRENT MOTORS · GENERATORS · FLEXIBLE COUPLINGS



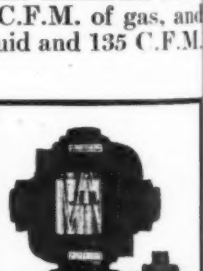
A Flow Rate ALARM that is EQUALLY SENSITIVE at all flow points

THE ROTASIGHT ALARM is an excellent flow rate alarm because the float, which actuates the alarm, responds to flow rate changes only. When we add, however, that the float reacts to flow changes with the same high sensitivity at all points in the flow range, it seems to justify the statement that the Rotasight Alarm is a *remarkable* flow rate protective device. The straight-line calibration curve, shown above, is typical of the Rotasight and proves that the float moves the same distance for a given flow increment at all points in the flow range, whether high or low. The result is a Flow Alarm that is positive and accurate at the exact flow rate where you desire protection.

The Rotasight is an area-type flow meter in which the float moves up and down in a precision-bore transparent metering tube fashioned with unique V-ported flutes. All of the flow goes through the meter and the float trips an external magnetic switch at the alarm point. The external switch is adjustable easily and quickly to any point over the entire flow range of the instrument.

The Rotasight is cast in iron and bronze in sizes from ¼" to 2½" inclusive. It will handle minimum flows of 0.03 G.P.M. of liquid and 0.06 C.F.M. of gas, and maximum flows of 60 G.P.M. of liquid and 135 C.F.M. of gas. Larger flows up to 14,000 G.P.M. liquid or 16,000 C.F.M. gas may be metered in our Rotasleeve Alarm.

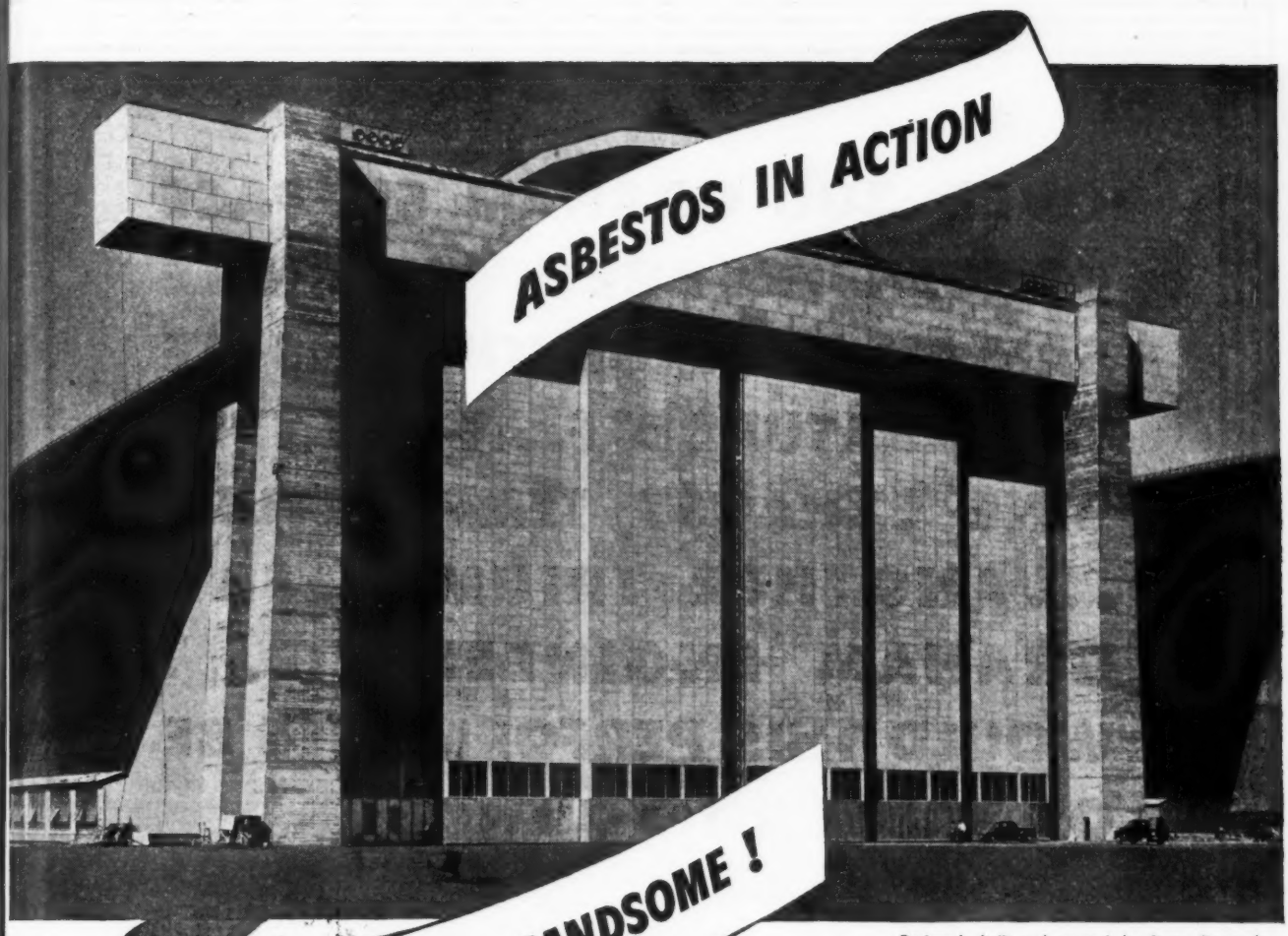
Leading manufacturers are using the Rotasight Alarm to protect expensive machinery and critical products. The full details are contained in an interesting new booklet 92-C, just off the press. You may obtain a free copy by writing us for it upon your Company letterhead.



The Rotasight Alarm may be equipped with explosion-proof switch housing for hazardous locations.

FISCHER & PORTER CO.

6004 County Line Road, Hatboro, Pennsylvania



Designed, built and erected by Byrne Doors, Inc., Detroit. Apac Sheathing installed by the Faulkner Construction Company. (Official U. S. Navy photograph.)

. . . and SAFE because it's sheathed with *"Century"* APAC

THE striking architecture of this Navy Blimp hangar is its own tribute! The doors are like skyscrapers . . . 120 feet high . . . 220 feet wide . . . weighing 300 tons. And they must open the entire width of the hangar in TWO MINUTES.

These giant portals must be the masters of wind and weather—for failure to open and close quickly might spell the doom of a wind-tossed Blimp. So they are completely sheathed with "Century" Apac—K&M's low cost asbestos-cement sheet material. It is rot-proof, rust-proof and fire-resistant.

Check these *"Century"* APAC advantages for construction and renovation work

1. Made of Asbestos Fibre and Portland Cement
2. Pleasing light gray color
3. Fire resistant and durable
4. Convenient size—4' x 8', 4' x 9' and 4' x 10'. (Three thicknesses—3/16", 1/4" and 3/8".)
5. Low cost
6. Rat and termite proof
7. Easy to cut, handle and apply
8. Fastens with nails or screws
9. Practically no maintenance required
10. Prompt delivery

In thousands of industrial plants, K&M "Century" Apac is used for roofing and siding, office paneling, sheathing in machine shops and stock rooms, linings for elevator casings and shower stalls. It is ideal for new construction, repairs or plant additions.

Enormous quantities of "Century" Apac have gone into wartime jobs. YET NOW THERE'S PLENTY AVAILABLE FOR YOUR INDUSTRIAL CONSTRUCTION WORK . . . without delay, without restrictions.

Nature made Asbestos

Keasbey & Mattison have been making it serve mankind since 1873 . . . with products like "Century" Apac, "Century" Asbestos Corrugated and Flat Lumber, Ebonized Asbestos, High Temperature Insulations and others. Interested in modern Asbestos and Magnesia materials? Write!

KEASBEY & MATTISON
COMPANY · AMBLER · PENNSYLVANIA

OVER 300 GRAHAM SURFACE CONDENSERS ARE GIVING UNCLE SAM AN AVERAGE CONDENSATE TEMPERATURE 6° F. ABOVE TURBINE EXHAUST TEMPERATURE ...ANOTHER TRIUMPH FOR GRAHAM ENGINEERING... WOULD THIS PERFORMANCE BE OF VALUE TO YOU?

Another "first" for Graham. The above statement is based on offical trial run records of over 300 vessels equipped with Graham twin bank condensers. This unique arrangement of the tube sheet layout actually produces elevated pressures in the hotwell with a corresponding rise in condensate temperature.

AWARDED THE MARITIME "M" PENNANT AND VICTORY FLEET FLAG APRIL 8, 1944

GRAHAM MANUFACTURING CO., INC.

415 LEXINGTON AVENUE • NEW YORK 17, N. Y.

Chalk Talk No. 1

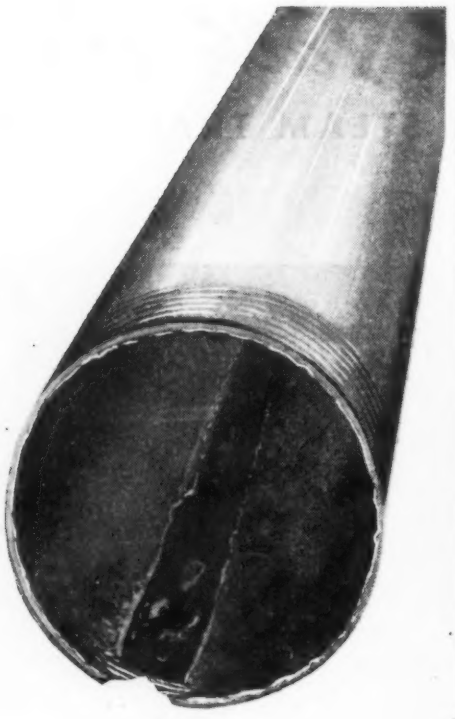
ON POSTWAR STEAM TRAP ECONOMY

● The blackboard illustration shows the savings in installation cost between a Super-Silvertop Steam Trap with simplified piping and an old style trap with complicated piping. While costs vary in different localities, in one locality there was a saving of $6.72 per trap in favor of Super-Silvertops. Figured on a number of traps, such savings mount up. Then, too, remember that each time a trap is removed from the line for inspection, there is an additional cost of $1.75.

Think about these economies when considering postwar Steam Trap requirements. For true economy, choose Super-Silvertops. For complete details, send for a copy of the book, "How to Choose A Steam Trap".

THE V. D. ANDERSON CO.
1934 WEST 96th STREET · CLEVELAND 2, OHIO

Super-Silvertop
STEAM TRAPS



You Don't HAVE to put up with Corrosion in Your Steam and Condensate Lines

CORAVOL IS PART OF A COMPLETE TECHNICAL SERVICE WHICH PROVIDES SPECIAL FORMULAS OF TREATMENT FOR:

Boiler Feed Water . . .
Hot Water Supply . . .
Refrigerating Brine . . .
Cooling and Condenser Water . . . Rapid Scale Removal . . . Coagulation . . . Algae Control

LINES CORAVOL BOILER

The use of **CORAVOL** saves you costly pipe repairs, replacements, maintenance labor, hours and days of shutdown loss. **CORAVOL** (1) *prevents corrosion* in steam and condensate lines, (2) *cleans out* clogging rust deposits already present. Thus, **CORAVOL** *protects lines;* increases effectiveness of heat transfer surfaces; restores original capacity of lines and the operating efficiency of valves and traps.

CORAVOL is NOT a boiler feedwater treatment. It is designed expressly for use in steam systems. Because **CORAVOL** volatilizes and condenses with the steam, it circulates thruout your entire steam system and protects *all* zones from corrosive attack.

For 8 years, **CORAVOL** has proved its value in hundreds of steam heating, process and power plants in more than 20 different industries.

Mail the coupon TODAY for complete FREE data about the **CORAVOL** process.

MAIL TODAY

WESTERN CHEMICAL COMPANY
715 Washington Street — Kansas City 6, Missouri

Without obligation to me, please send complete data on the CORAVOL Process

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

CITY AND STATE _____ (1)

HOLTZER-CABOT ELECTRONIC INSULATION TESTER

Can Help Prevent Production Delays, Shut-Downs and Costly Repairs

By spotting faulty insulation before it breaks down, the Holtzer-Cabot Insulation Resistance Tester enables you to plan and make repairs before they become costly. Light in weight, portable and easy to use, this unit is ready to use anywhere by engineers or maintenance men.

CHECK THESE ADVANTAGES

√ *Hand Generator* eliminates batteries . . . delivers 500 volts D.C. testing voltage.

√ *Electronic Voltage Regulation* assures uniform testing voltage.

√ *Two Indicator Buttons* light up when generator delivers correct testing voltage assuring accurate readings.

√ *Guard Circuit* eliminates surface leakage from affecting measurements.

√ *Light Weight* . . . only three pounds. Makes it ideal for field work.

Range 0 to 100 megohms.

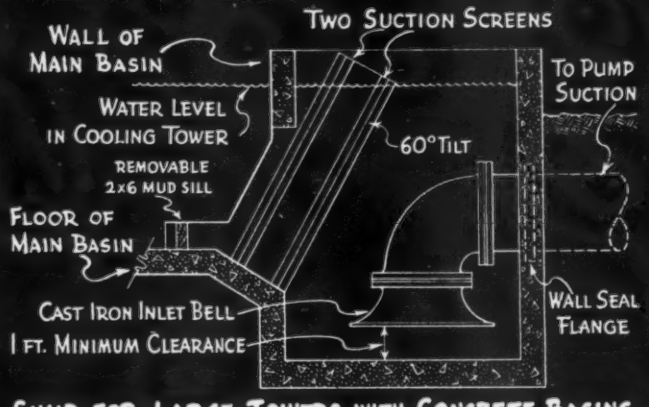
Write for bulletin. It gives the complete story.

HOLTZER-CABOT
Division of First Industrial Corp.
400 STUART STREET, BOSTON 17, MASS.

Cooling Tower DOs and DON'Ts
-by MARLEY (No. 6 of a series)

POINTERS ON THE WATER CIRCUIT

In any type of a cooling tower these items are important to operating convenience and economy, as well as efficiency:



Sump for Large Towers with Concrete Basins

High Screen extending above water. Sectionalized for easy removal, cleaning & replacement
Safety Overflow with "umbrella" to shed spray
Anti-Cavitation Plate
Water Level
Float Valve
Sump belled to minimize friction
Basin Floor
Basin Side Wall

Sump for Small Towers with Wood or Steel Basins

ACCESSIBILITY—Are all parts requiring periodic inspection, cleaning or adjustment easy ro "get at"?

PIPING & DISTRIBUTION SYSTEM—Are supply and return lines of ample size? Does layout of risers, headers and arms offer least possible friction and require the least lift practicable? If tower loadings or local wet-bulb vary much, is the system adequately sectionalized and is water distribution fully effective at various loadings in each section independently? Are nozzles, if used, of non-clog design with large orifices?

PUMPS—Are pumps of adequate capacity, advantageously located? Are they needed on both supply and return? Is a "stand-by" advisable?

VALVES—Are there enough valves and properly located for convenient flexibility of tower operation (i.e. to cut off or cut down water to the separate sections, to partially or totally by-pass the distribution system in cold weather, etc.) thus saving pumping cost when tower's maximum performance is not required?

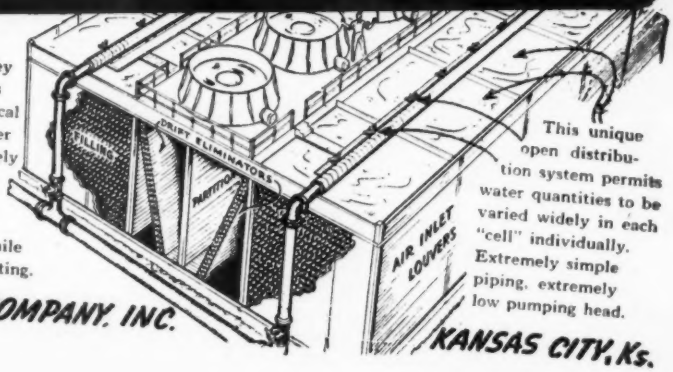
BASIN—Is the catch basin of ample depth, with automatic float valve for make-up? Have ALL factors governing design and material (concrete, steel or Redwood) been OKed by both tower manufacturer and purchaser?

SUMP—Is the small tower's sump set leak-proof in the Redwood or steel basin, screened to keep out debris, belled to ease flow, with anti-cavitation plate to prevent air intake? Does the large tower's concrete sump have double screens (so one remains in place while other is being cleaned), is area through screens ample and is the suction bell lower than the main basin's floor?

MARLEY COOLING TOWERS

15-A

DO YOU KNOW—the Marley "Double-Flow" is the only mechanical draft cooling tower having a completely *external* distribution system; all parts easy to see and reach even while the tower is operating.



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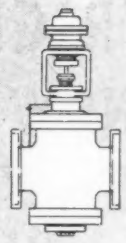
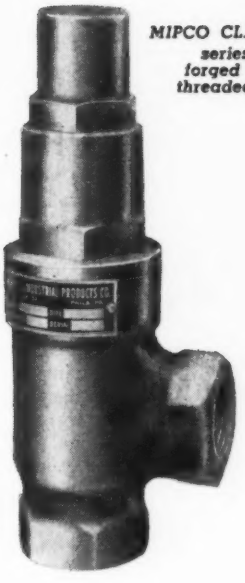


Control problems?



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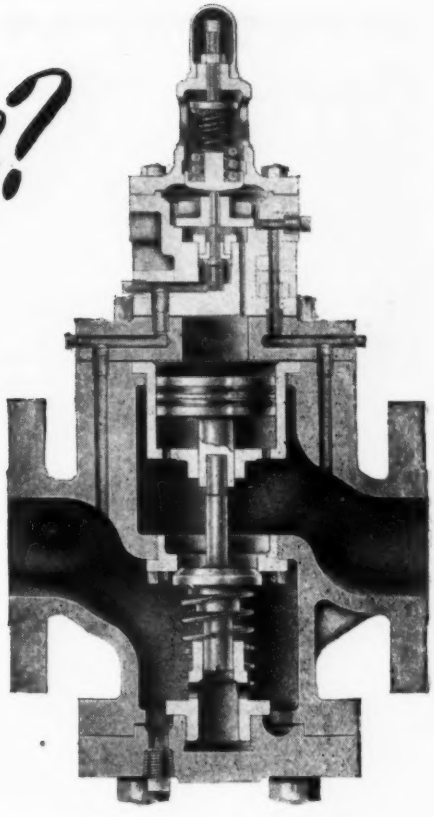
threaded ends



Schade No. 230 internal pilot operated pressure regulator.

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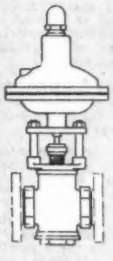
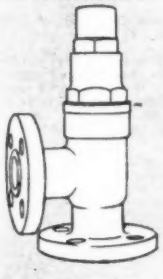
series 120
cast steel,
iron or bronze.





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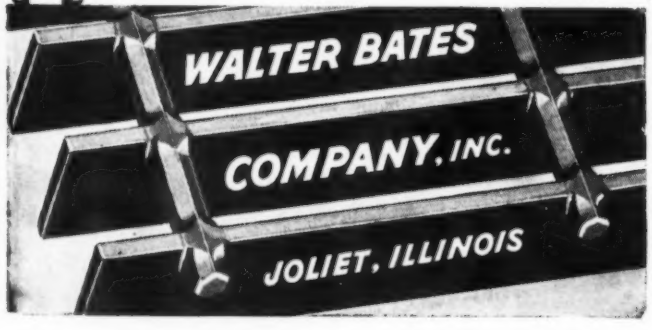

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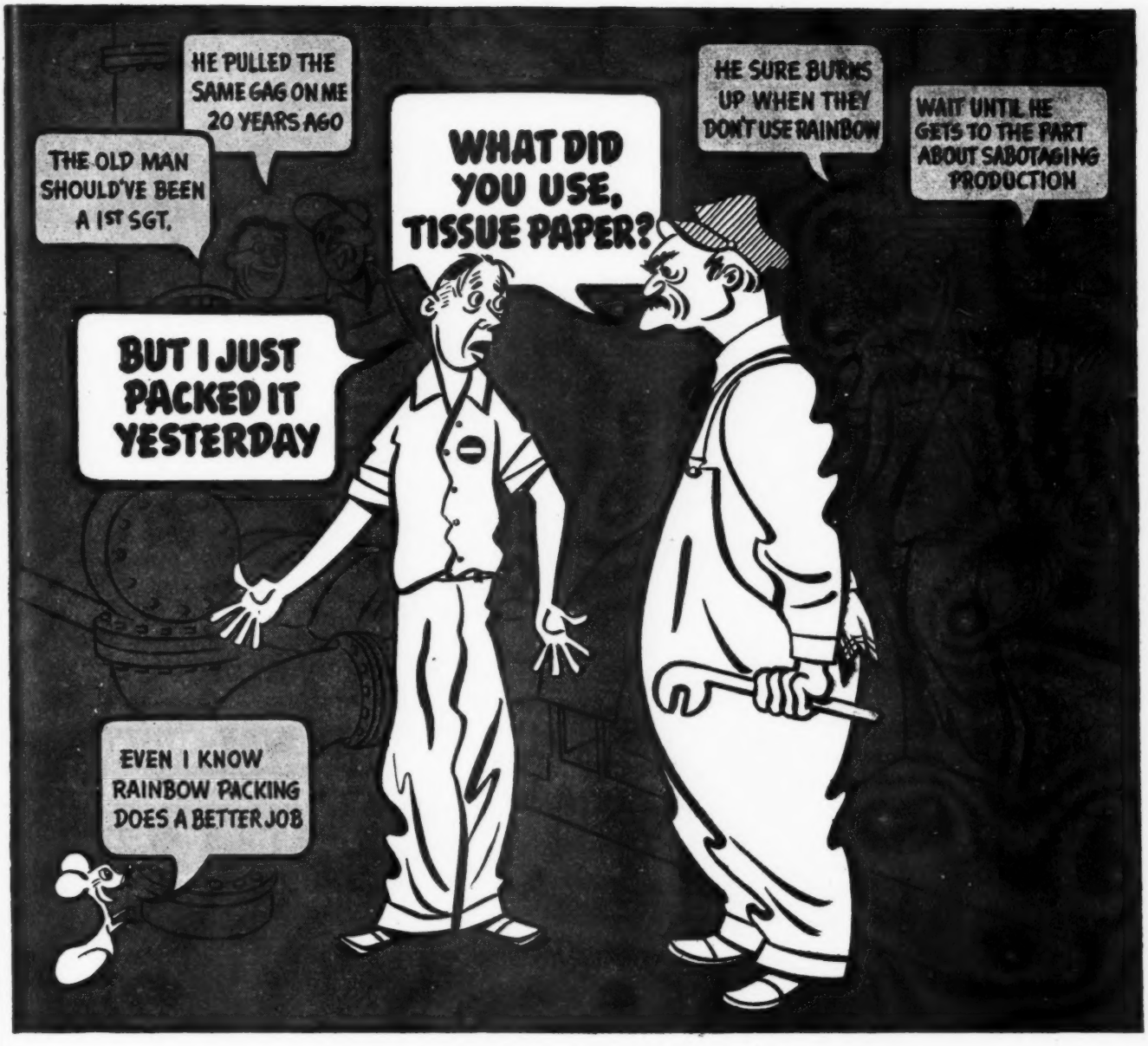
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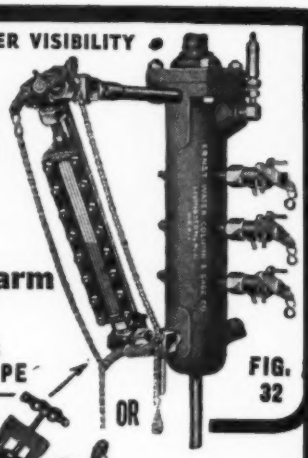

FIG. 32

OR

SPLIT GLAND TYPE

FIG. 1

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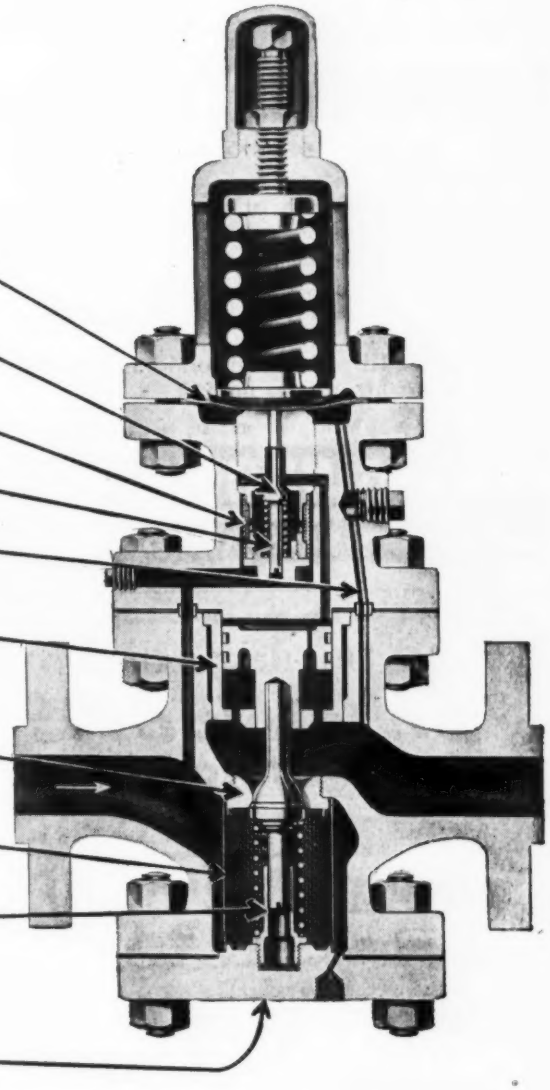

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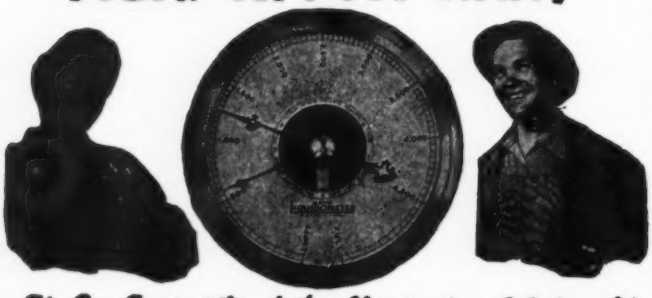

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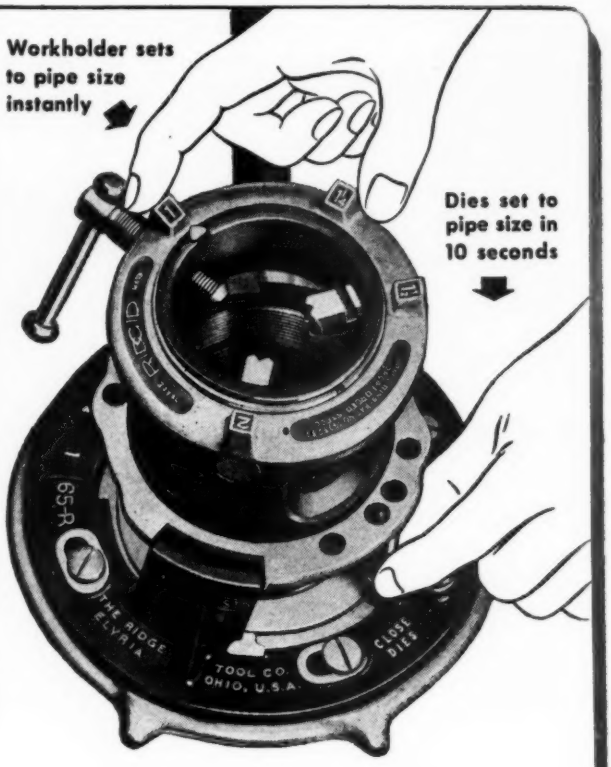
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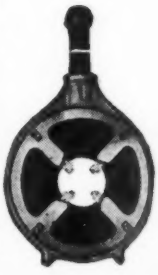

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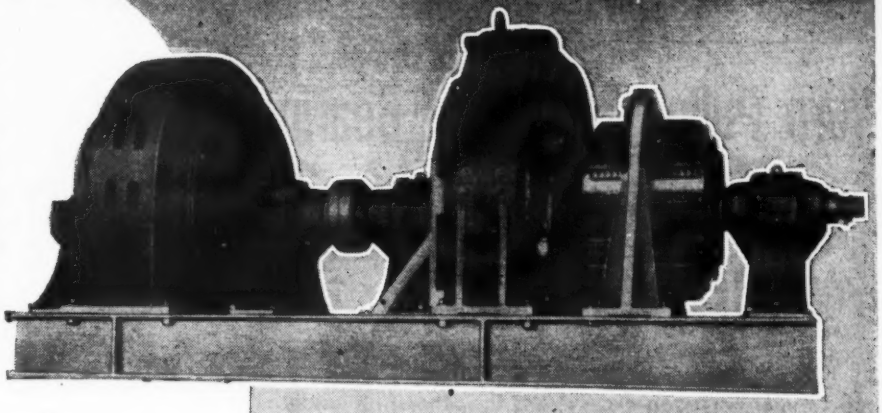

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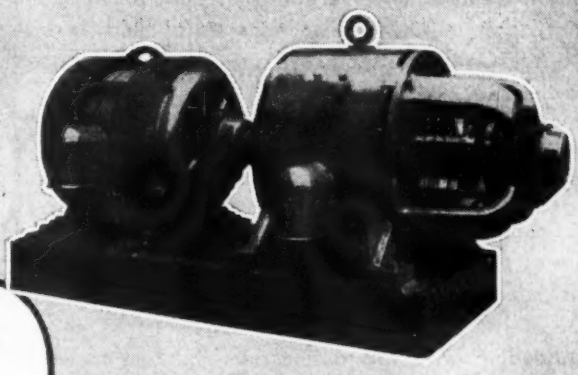

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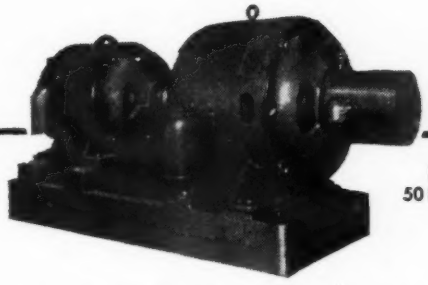

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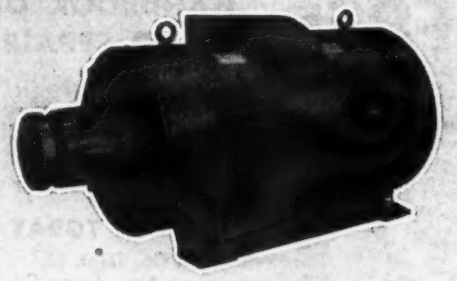

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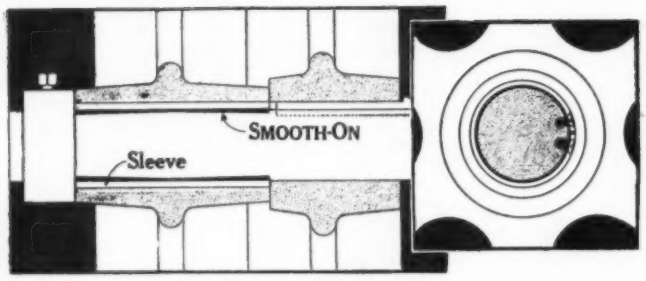

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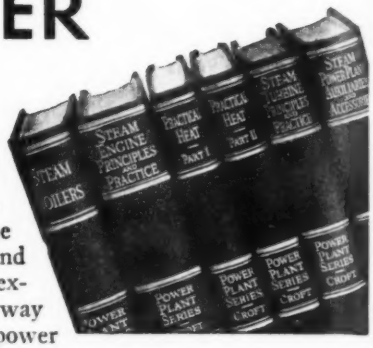

War or peace, keeping the wheels of industry and the nation's utilities turning is a basic job—one there's always room and big money in for the expert. Take the short-cut way to a better paying power plant job. Do as thousands of others have, to their definite gain—spend a short time daily and systematically reading and using these books.

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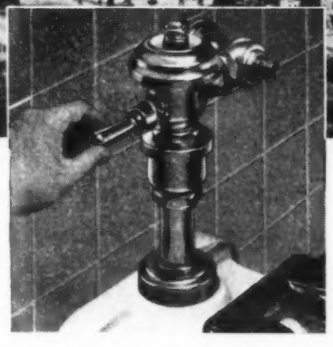

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For complete information on models and combinations of Watrous Flush Valves ask for Catalog No. 448-A. For helpful information on trends in the application of flush valves also ask for Bulletin No. 477.

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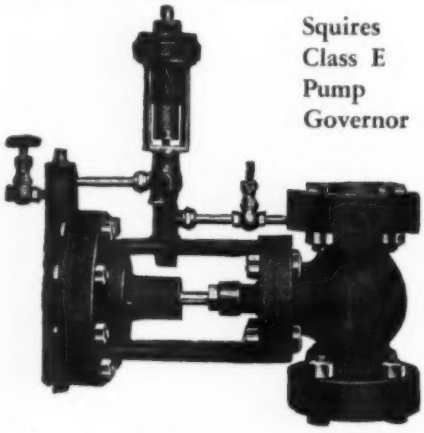

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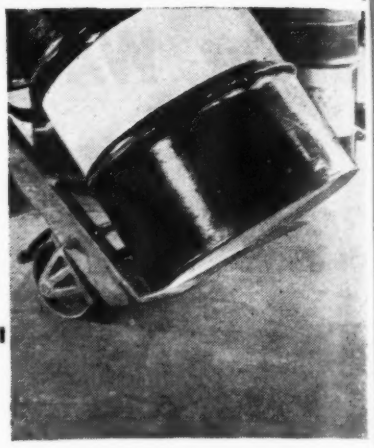

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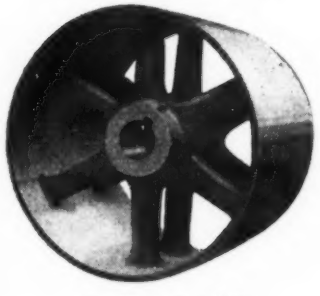

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JONES cast iron pulleys are true running — they permit higher speeds — no bushings and they can't fall apart — they don't rattle and they look better on most machines.

These pulleys are machine molded, poured of high test cast iron, and are accurately finished and balanced. Multiple piece pulleys, rubber covered pulleys and flywheels can be furnished.

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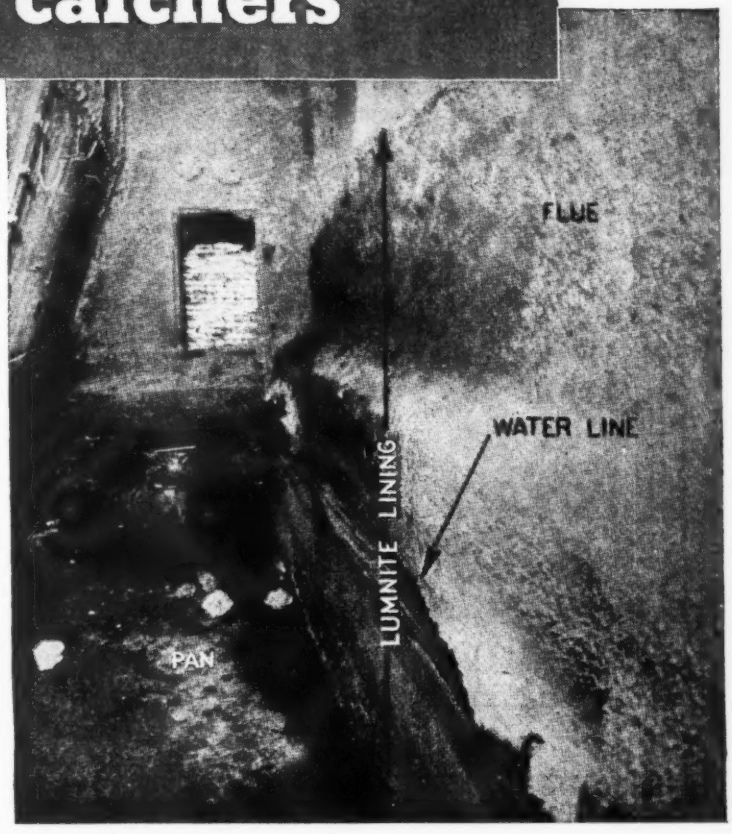
How to stop corrosion in cinder catchers

Concrete Linings made with LUMNITE outlast metal . . . sharply reduce maintenance repairs and costs.



The corrosion and deterioration of "wet type" cinder catchers caused a large power plant plenty of trouble and expense.

THIS WAS THE SITUATION at one of its stations: The water in the pan absorbed sulphur gases from the passing flue gas and soon contained quantities of sulphurous and sulphuric acids and sulphates. This mixture corroded the metal walls of the cinder catchers. Deterioration of the steel was hastened by abrasive effect of gas-borne fly ash and cinders.

HERE IS WHAT HAPPENED: Steel plates became slotted, cracks developed in welded joints, and corrosion left plates pitted and thin. Replacement of a section of the end wall was necessary at intervals of from three to six months.

THE SOLUTION—CORROSION-RESISTANT CONCRETE LININGS: Since no metal lining was found to resist deterioration, tests were run on concrete made with different cements and aggregates. A lining of Corrosion-Resistant Concrete made with LUMNITE was shot over steel reinforcing mesh. This 2½-inch lining was placed on side walls and on the flue above the pan.

The dense lining of LUMNITE Concrete showed only hairline cracks after a year's service. It was unaffected at the water line. There was no abrasive effect because corrosion had not weakened and softened the concrete.

THE RESULTS: All 26 cinder catchers at this station today have LUMNITE concrete linings. Maintenance repairs have practically been eliminated, with a resultant saving of thousands of dollars. Reduction of time for repairs has increased station efficiency.

LUMNITE has other important power plant uses. It protects ash hoppers and coal bunkers from corrosion. It provides insulating abrasion-resistant linings for flues and stacks. For more information on LUMNITE in power plants, write:

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● Castable refractories are factory-prepared mixtures of LUMNITE and selected aggregates. Packed dry, they are mixed with water on the job and cast into place for door linings, arches, baffles or furnace walls. Special shapes can be cast in simple molds and are ready for use within 24 hours.

Castables to meet different temperature and insulation needs are made by refractory manufacturers and sold by their distributors.

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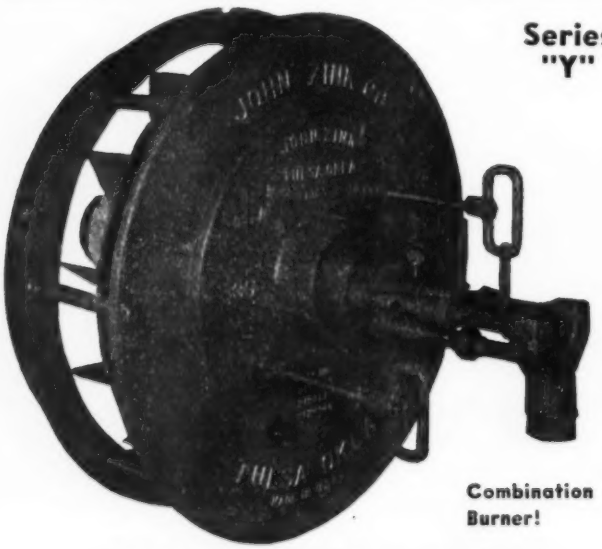

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Fuel scarcity is no problem if you use John Zink Series Y Burners because this burner burns either, or both, gas and oil with the same heat pattern.

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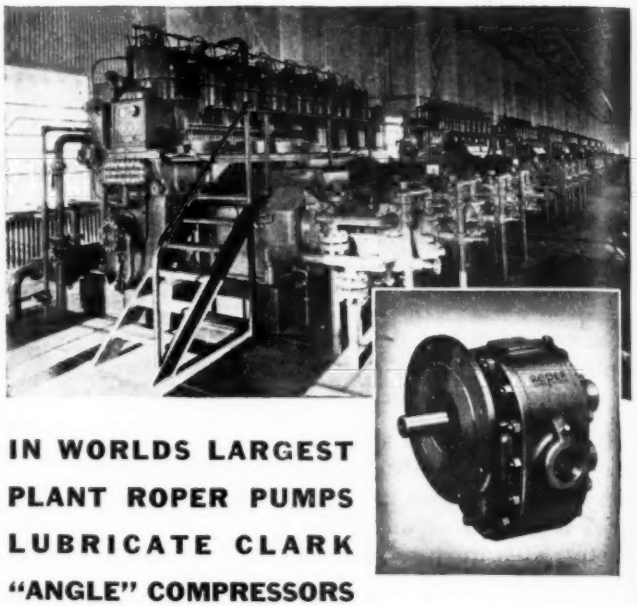
BIG BUTADIENE BATTERIES



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In this huge plant where 100,000 tons of Butadiene is produced annually . . . approximately one-seventh of the nation's requirements . . . Roper Pumps are functioning efficiently as integral parts of the giant compressors.

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Roper Rotary Pumps, used on all Clark Engine Compressors, supply positive pressure lubrication to all bearings and a spray of oil to piston domes, which cools piston metal and eliminates ring sticking. For various Clark Units, the Ropers are supplied in 40, 50, 75, and 100 G.P.M. sizes, and operate at pressures of 50 lbs. P.S.I. Pumps operate at a rated speed of 300 R.P.M. This Roper equipped pressure lubricating system greatly increases the load bearing capacity of bearings and decidedly reduces maintenance costs.

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ROPER Rotary Pumps

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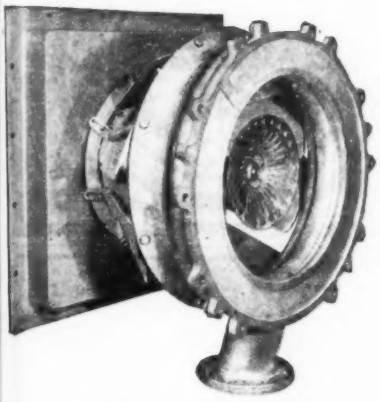


Combined Oil and Gas Burner—Forced Draft.

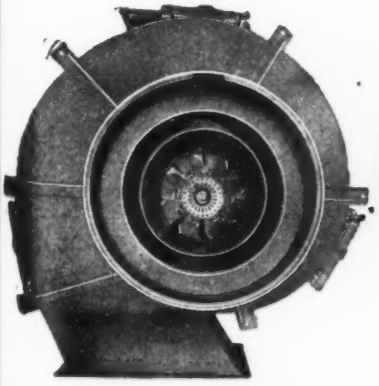
Combined Oil and Gas Burner—Natural Draft.

Combined burners, built to fire oil and pulverized coal, gas and oil, or all 3 fuels, are an invaluable development pioneered and perfected by Peabody. They are in successful service in hundreds of power plants, utility central stations and industrial installations of all types.

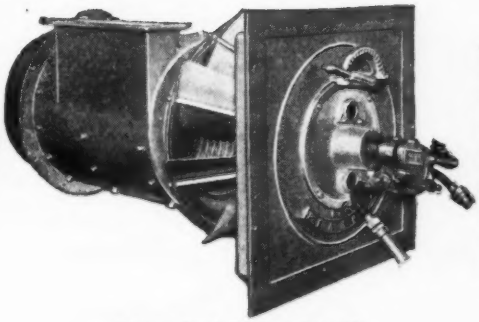
Their advantages are numerous, but most attractive of all is the freedom they give in the choice of fuels when supply problems are difficult.

You can specify Peabody Combined Burners with full assurance of top combustion efficiency with any fuel fired and with the assurance of long service that results from good design and sturdy construction.

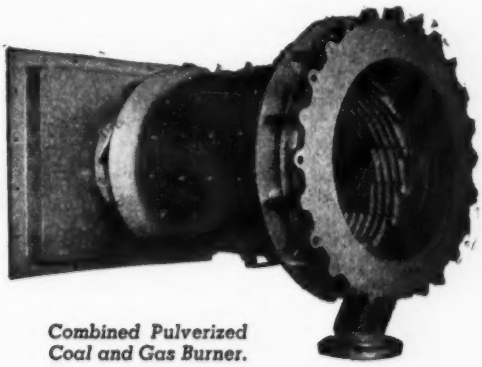
Peabody engineers, experienced in all phases of combustion, are available to assist in working out your requirements successfully.



Combined Blast Furnace Gas and Oil Burner.



Three Fuel Burner for Oil, Gas and Pulverized Coal.



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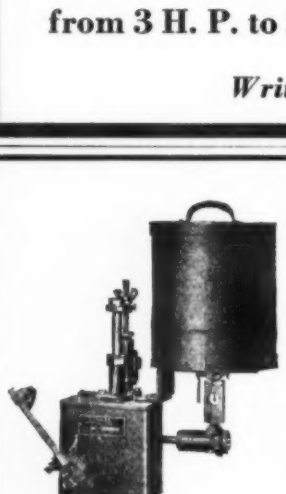

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Thousands of users have learned that lubrication problems disappear with the installation of Manzel Lubricators. Engines, pumps, compressors and heavy machine tools all need the dependability of Manzel lubrication.

Starting, stopping, speeding up and slowing down with the engine, Manzel lubricators deliver exactly the right amount of oil with clock-like regularity. Feed is very accurate and easily regulated. Once set, the only attention required is to maintain the oil supply in the reservoir.

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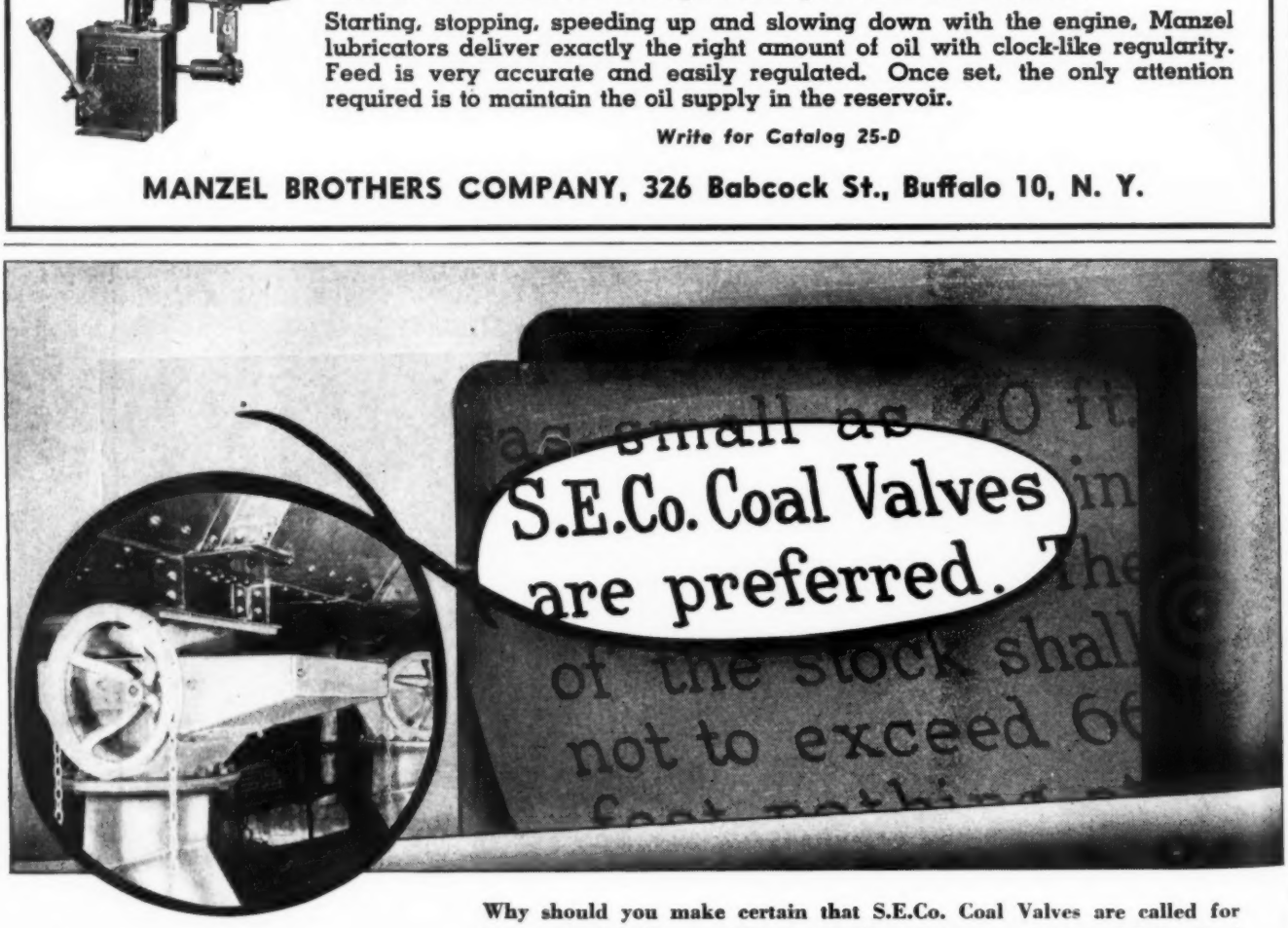

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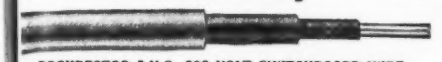
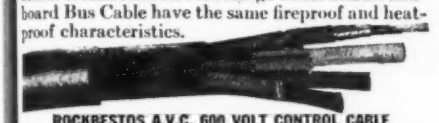
Permanently Insulated ROCKBESTOS Wires, Cables and Cords



ROCKBESTOS A.V.C. 600 VOLT SWITCHBOARD WIRE
(National Electrical Code, Type AVB)

Sizes No. 18 to No. 4/0 AWG with varnished cambric and impregnated asbestos insulation and gray, black, white or colored fameproof braid.

Combine fire insurance and fine appearance in your switchboards with Rockbestos Switchboard Wire. It is fireproof and will not dry out under heat. Sharp, clean bends can be made without cracking as the asbestos wall acts as a cushion under the braid. Rockbestos A.V.C. Hinge Cable and Switchboard Bus Cable have the same fireproof and heatproof characteristics.



ROCKBESTOS A.V.C. 600 VOLT CONTROL CABLE

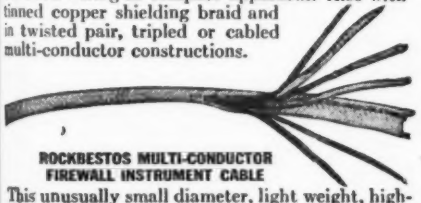
In one to 19 conductors with individuals insulated like Motor Lead Cable, cotton braid covered and cabled with an asbestos braid over all. Standard strandings AWG No. 12—19/#25 and No. 9—19/#22. Other strandings on order.

Designed for use in equipment requiring a multi-conductor control cable capable of withstanding high temperatures, this cable is widely used in the control systems of electric cranes manufactured for use in steel mills. The insulation is unaffected by heat, corrosive fumes, oil or grease and has ample moisture resistance.

ROCKBESTOS FIREWALL RADIO HOOKUP WIRE

Size No. 22 to 4 AWG in 1000 volt rating, and No. 12, 14 and 16 AWG in 3000 volt insulated with high dielectric synthetic tape, impregnated felted asbestos and covered with color coded lacquered glass braid.

The first small diameter heat and flame resistant high-dielectric hookup wire, designed in 1937 and approved by the C.A.A. for use in airborne radio equipment. Widely used since in automotive and ground communications systems, electronic devices and apparatus. Operating temperature range 125° C. to minus 50° C. Ideal for small motor, coil, transformer and dynamotor leads and bunched wiring in compact apparatus. Also with tinned copper shielding braid and in twisted pair, tripled or cabled multi-conductor constructions.



ROCKBESTOS MULTI-CONDUCTOR FIREWALL INSTRUMENT CABLE

This unusually small diameter, light weight, high-dielectric 3 conductor No. 26 AWG cable, with individuals insulated like our Radio Hookup Wire, was designed for an electronic device in which three No. 22 AWG single conductor aircraft wires proved too bulky. It is made to a nominal diameter of .125" (smaller than a 14 AWG single conductor 1000 volt Rockbestos Firewall Radio Hookup Wire). Also in 4 and 5 conductor constructions.

ROCKBESTOS THERMOSTAT CONTROL WIRE

Sizes No. 14, 16 and 18 AWG in two to six conductors with .0126", or .025" or (for 115 volt service) .031" of impregnated felted asbestos insulation and steel armor.

A multi-conductor control wire for low voltage intercommunicating, signal, and temperature control systems. Lifetime heatproof, fireproof insulation and rugged steel armor give troubleproof circuits.

ROCKBESTOS ASBESTOS INSULATED MAGNET WIRE

Round, square and rectangular asbestos insulated conductors finished to meet varying winding conditions and coil treatment requirements.

Protect your motors against heat-induced breakdowns with class B windings of Rockbestos Heat-Resisting Magnet Wire. Leads of Rockbestos A.V.C. Motor Lead Cable will complete the failure-proofing.

ROCKBESTOS APPARATUS HEATING CABLE

No. 19 AWG nickel-chromium resistance wire insulated with .040" of impregnated felted asbestos and covered with 4/64" waterproof lead sheath.

Manufacturers of photographic developing tanks, dry print developing machines, candy making equipment, soil heating cable kits and other devices requiring controlled distribution of mild heat can use this pliable heating cable to advantage. Also useful in preventing freezing of water pipes and congealing of oil, grease, ink, paint and sluggish fluids in conveyor pipes.

ROCKBESTOS 300 VOLT HEAT RESISTING FIXTURE WIRE
(Underwriters' Type AF)

Sizes No. 10 to 18 AWG stranded plain copper conductor insulated with black or white impregnated felted asbestos—with or without braid.

Rockbestos asbestos insulated fixture wires, approved by the Underwriters' Laboratories, are ideal for lighting fixture wiring because their heat resistant insulation will not bake out under the high socket temperatures developed in modern fixtures. Also used for small motor leads, miniature switchboards, business machines, radios, etc.

ROCKBESTOS ALL-ASBESTOS APPLIANCE LEAD WIRE

Sizes No. 8 to 20 AWG solid or stranded copper, monel or nickel conductors insulated with .031" or .040" of impregnated felted asbestos in black, white or colors.

Whether you make waffle irons, hot-plates, small motors, ranges, water heaters, radios, ovens or blueprint machines, we can give you an asbestos lead wire made to fit the electrical and mechanical requirements of your product.

ROCKBESTOS ALL-ASBESTOS 600 VOLT FLEXIBLE CORD

Sizes No. 10 to 18 AWG with two or three conductors insulated with impregnated felted asbestos and covered with a heavy asbestos braid.

This heavy duty heat-resisting flexible cord is ideal for high wattage lighting units, apparatus, floodlights, etc., that are used in hot spots or develop heat in operation. For moisture resistant type specify the Rockbestos A.V.C. construction described below.

ROCKBESTOS A.V.C. 600 VOLT FLEXIBLE CORD

Sizes No. 10 to 18 AWG with two or three conductors insulated with impregnated felted asbestos, varnished cambric, felted asbestos and covered with a heavy impregnated asbestos braid.

For applications such as mentioned above in which heavy duty, high-dielectric, heat and moisture resistant flexible cord is required we recommend this construction with individual conductors insulated exactly like Rockbestos A.V.C. Motor Lead Cable. Approved for lighting applications, with polarized conductors, by Underwriters' as Style V flexible cord under a 300 volt rating. Specify if so desired.

ROCKBESTOS 300 VOLT HEAT RESISTING DUPLEX FLEXIBLE CORD
(Underwriters' Type AFPD)

Sizes No. 10 to 18 AWG stranded plain copper conductors insulated with impregnated felted asbestos, polarized, twisted together and covered with a cotton braid.

This duplex heat resisting flexible cord is approved by the Underwriters' Laboratories for use in fixtures and is recommended for pendant types as the asbestos insulation will not dry out or crack at the socket. It provides protection against wire-failure, eliminates fire-hazard and gives permanent suspension as it does not deteriorate with heat or age. Also in twisted pair, tripled and triplex.

ROCKBESTOS A.V.C. 600 VOLT MOTOR LEAD CABLE
(National Electrical Code, Type AVA)

Size No. 18 AWG to 1,000,000 CM insulated with two walls of impregnated asbestos and a high-dielectric varnished cambric insert, with a heavy asbestos braid overall.

Heatproof, fireproof, greaseproof and oilproof, will not dry out and crack, won't burn or carry flame, and remains permanently flexible For coil connections, motor and transformer leads where extreme heat and fire hazards are encountered as in steel mills, etc.

ROCKBESTOS A.V.C. 600 VOLT POWER CABLE
(National Electrical Code, Type AVA)

Sizes No. 18 AWG to 1,000,000 CM insulated with laminated felted asbestos, varnished cambric, and asbestos braid Other constructions for service voltages to 5000.

Use Rockbestos A.V.C Power Cable for the internal wiring and power leads of heat-exposed heavy electrical equipment and hot-spot wiring in conduit around boiler rooms, steam lines, furnaces, etc., as it withstands high temperatures and has ample moisture resistance.

ROCKBESTOS A.V.C. 600 VOLT BOILER ROOM WIRE
(National Electrical Code, Type AVA)

Sizes No. 18 to 8 AWG insulated with varnished cambric, impregnated felted asbestos and asbestos braid. Sizes 6 to 4/0 have another wall of impregnated asbestos next to the conductor

For lighting and control circuits exposed to heat and moisture, oil, grease, corrosive fumes or fire hazard, such as exist around furnaces, ovens, lehrs, soaking pits, boilers, etc., this widely used A.V.C. construction is ideal. Its permanent insulation will not bake brittle, crack, rot, flow or swell

ROCKBESTOS ALL-ASBESTOS 600 VOLT RHEOSTAT CABLE
(National Electrical Code, Type AI)

Sizes No. 18 AWG to 1,000,000 CM insulated with a heavy wall of felted asbestos, covered with a rugged asbestos braid finished in black, white or colors.

Use this power and rheostat cable for wiring rheostats, switchboards, elevator and locomotive control panels and electrical equipment exposed to heat, fumes and fire hazard. Also for general open wiring in dry, high temperature locations. For flexible stranded conductor specify Rockbestos All-Asbestos Flexible Apparatus Cable. For solid conductor specify Rockbestos All-Asbestos Rheostat Wire.

A few of the National Electrical Code types and other constructions in the Rockbestos line of 125 different *permanently insulated* wires, cables and cords designed to give long-lived, dependable service under severe operating conditions — all built to resist such wire-destroying hazards as heat and moisture, oil, grease, corrosive fumes and flame. For complete information or samples, write to:

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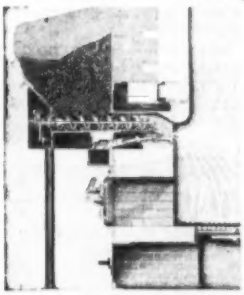
RESIST Heat, Moisture, Oil, Grease and Fumes WON'T Bake Brittle, Bloom, Burn or Rot

FYR-FEEDER STOKERS

MULTIPLE SPREADER

BURN COAL LIKE OIL!

Save with Fyr-Feeder—Burn less Coal—Cheaper coal—Local coals—Screenings—Coal yard sweepings, wet or dry—Wet coal is no handicap.



FYR-FEEDER

exclusively uses

←Air JET Coal PROPULSION

Fines burn in suspension, larger pieces are spread evenly over grates.

Fyr-Feeder increases boiler capacity—responds instantly to sudden load variations—requires no special skill or experience to operate—thin fuel bed eliminates clinkers—makes firemen's work much easier—no banking losses.

CHANGE OVER TO FYR-FEEDER NOW!

Easily installed in minimum time.

Fyr-Feeders are built in sizes to burn from 300 to 12000 lbs. of coal per hour. If you are or expect to be in the market for automatic coal burning equipment

Wire or Write
FYR-FEEDER Stoker Division
AMERICAN COAL BURNER COMPANY
Engineers

32-18 E. Erie St. Chicago 11, Ill.

GIVE ALL YOU CAN

TO THE

RED CROSS

IT GIVES ALL

IT CAN TO OUR

BOYS OVERSEAS

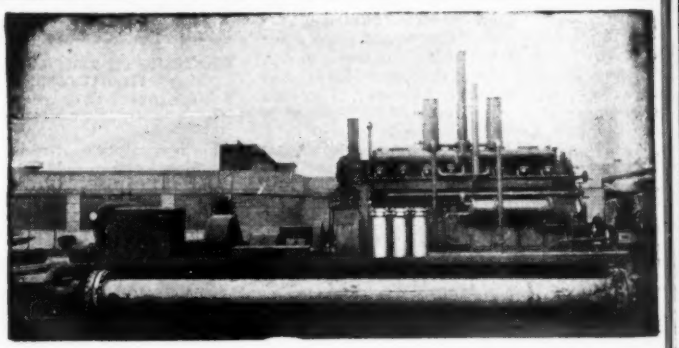
YOU CAN

ADD HOURS

TO THE LIFE OF
DIESEL ENGINES

with

NUGENT FILTERS



HERE'S a filter that's a sure bet when it comes to providing positive protection for Diesel engines. The Nugent Absorbent Depth Type Pressure Filter shown at the left absorbs four times its own weight of water and impurities yet it does not remove any of the essential additives embodied in the oil. Available in a wide range of sizes for Diesel engines from 1 to several thousand H.P. in single containers.

Diesel operators who can't take a chance with power interruptions rely on Nugent Filters to add hours of life to Diesel engines . . . reduce maintenance costs as well as increase engine efficiency.

The photo above shows one Nugent Absorbent Type Fuel Oil Filter and two Nugent Lubricating Oil Filters installed on a Cooper-Bessemer Diesel engine which is connected to Worthington centrifugal pump. The installation is located at a well known pipe line station.

NUGENT TRADE MARK

WRITE TODAY for Latest Bulletin

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402 N. Hermitage Ave. Chicago 22, Ill.

SINCE 1897

NUGENT FILTERS

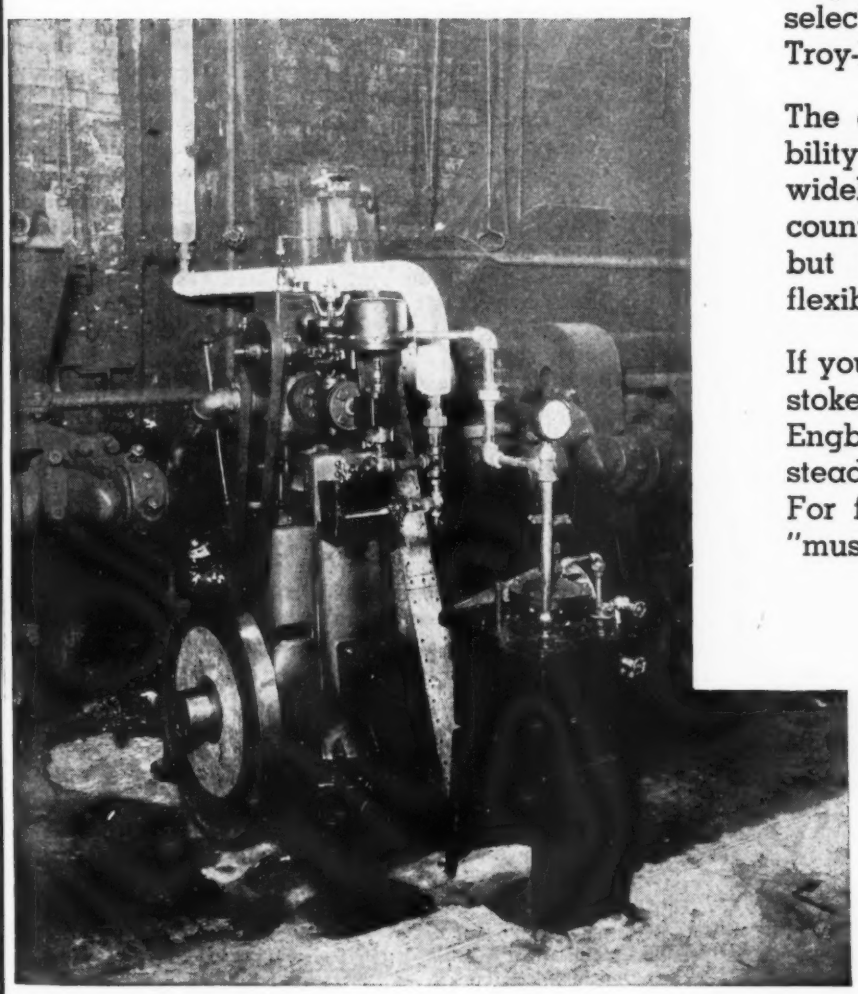
TROY-ENGBERG STEAM ENGINE

The Flexible Drive for Stokers

A FEW years ago one of the largest power generating stations in the country put through some far-reaching modernization steps. Would it surprise you to learn that the drive selected for the 48 stokers was the Troy-Engberg Steam Engine?

The objective was maximum flexibility of the drive to meet the plant's widely varying loads. Dependability counted, of course, also efficiency but the major requirement was flexibility.

If you are planning to install a new stoker be sure to check on the Troy-Engberg Steam Engine. Even for steady loads, it has much to offer. For flexible loads it's almost a "must."



TROY ENGINE & MACHINE CO.

Established 1870

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4-TEM-2

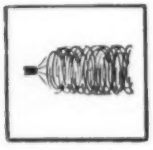
New O & S

Powermaster

STEAM GENERATING UNIT

Fully automatic, the Powermaster is a complete power plant in a "package." Compact. Easy to install. No stack is needed—induced draft insures complete combustion and high thermal efficiency.

Pre-tested, completely wired and mounted, the Powermaster is ready to go at the flick of a switch. Designed by O & S engineers to give you speedy steam—economically.



Its pressure-atomizing oil burner gives a rotary motion to the flame. Assures longer gas travel, greater heat transmission, more complete combustion.

Get full information—write for Powermaster Bulletin # 1213, to Orr & Sembower, Inc., 000 Morgantown Rd., Reading, Pa.

ORR & SEMBOWER INC.

READING O&S PENNA.

Builders of Better Boilers Since 1885

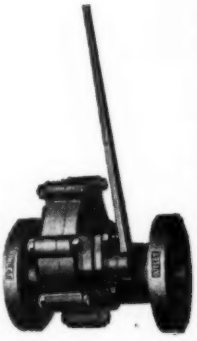
The ACID TEST *—literally!*

These six (6—count them!) EVERLASTING valves on the acid lines of this chemical plant, are just a few of the many EVERLASTING valves which have faithfully served there for many years. Valves which can stand up under the acid test of such heavy duty — can readily enough serve *dependably* on YOUR operations!

This chemical plant requires valves which open to full-pipe-size straight-through flow — or close to a drop-tight seal — *instantly*. They require valves which can withstand the erosive and corrosive ordeal of the various acids and other chemical fluids that are alternately flowed through these process pipe lines . . . "The Acid Test" — literally! That's why their engineers specified these EVERLASTING valves many years ago . . . and still have no regrets!

Because of their 24-hour operation, this chemical plant does not use valves which would require the usual periodic maintenance, necessitating production shut-downs. That's why you see these EVERLASTING valves throughout the plant! Trouble-free . . . many not maintenanced in years of this gruelling service . . . dependably serving a long life sentence at hard labor! If *that's* the kind of valves you need — *then always specify EVERLASTING Valves!*

If you have a valve problem, please write and give us the details. Our valve engineering experience of over 35 years is at your service — without obligation.



Flanged or screwed types. Sizes: 1/4" to 16". For pressures to 300 lbs. To handle any specified fluid, valves built of any metal which can be cast and machined — and which will not gall.

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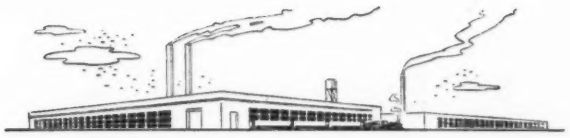
49 Fisk St., Jersey City 5, N. J.

Everlasting Valves

FOR EVERLASTING PROTECTION



PLANT PROVED

Masoneilan Pressure Control

provides accuracy and flexibility at moderate cost

MODEL NO. 2500

Especially designed to meet the requirements of processes which do not warrant expensive instrumentation. It gives you the advantages of instrument control at a cost comparable to less efficient methods by insuring accurate control of a wide variety of applications such as service on primary or auxiliary steam lines, turbine or bleeder make-up, pump discharge pressure control and evaporating systems. Available in ranges between 30 inches Hg. vacuum and 500 psi. Proportional band of from 3 to 50%.

MODEL NO. 2100

Proportional type controller designed for precise control of pressure. It is stable and smooth in operation assuring accuracy and uniformity under varying conditions. It is available in ranges between 30 inches vacuum and 10,000 psi in non-recording and recording types. Standard proportional band is 1 to 100%.

We suggest you investigate plant-proved Masoneilan Pressure Controllers for your plant. They may be the answer to your problem. Write for information.

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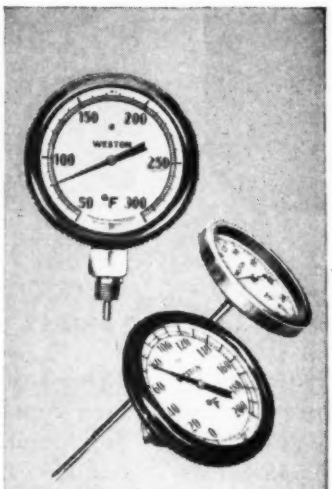
The *long-term* dependability of the WESTON thermometer stems from its rugged, all-metal construction. It consists of only a simple, durable all-metal temperature element safely encased in a stainless steel stem. No gases or liquids, no capillary, no complicated mechanical linkages, no fragile parts are employed. Because of this extreme simplicity, and the absence of so many common trouble points, WESTONS maintain their high initial accuracy *over far longer* periods. Thus they provide better protection for processes and equipment, and keep replacement and maintenance costs at a far lower level.

Literature describing these dependable and rugged thermometers, including types, stem lengths, prices, etc., gladly sent on request. WESTON Electrical Instrument Corporation, 679 Frelinghusen Avenue, Newark 5, N. J.



WESTON All-Metal Temperature Gauges are available in sizes and types for most industrial needs . . . as well as in laboratory models with full scale accuracy within ½ of 1%.

WESTON *All Metal* **TEMPERATURE GAUGES**

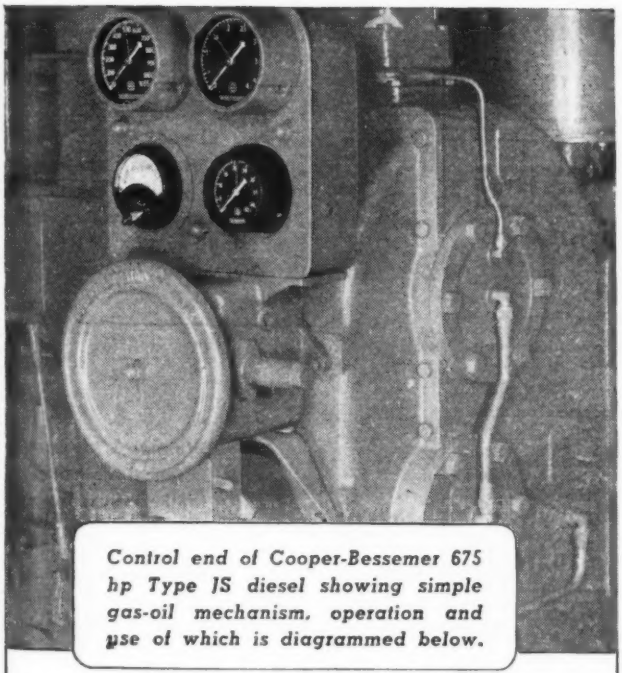
BUY MORE WAR BONDS NOW AND EVERY PAYDAY

Announcing — THE GREATEST DIESEL DEVELOPMENT IN YEARS

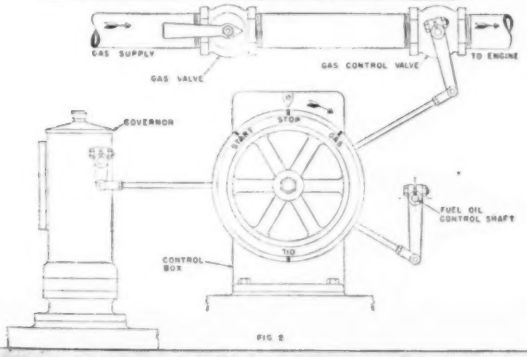
Ever since 1928, Cooper-Bessemer has been experimenting to perfect a means of using gas as a practical fuel for diesel engines; and to permit instantaneous change-over at full load from gas to oil fuel and vice versa. It can now be announced that these efforts have been completely successful — a truly revolutionary accomplishment.

TO POWER USERS THIS DEVELOPMENT MEANS:

1. Diesels, with all their inherent advantages, may now be operated with full efficiency on natural gas, sewage gas, refinery gas, manufactured and coke oven gases, etc., in preference to engines of the electrical ignition type.
2. Gas-fueled engines may now be utilized in locations where an electrical ignition system has heretofore been a preventative hazard.
3. Since the thermal efficiency of a Cooper-Bessemer diesel is so much higher than that of the best gas engines of the other type, *20 to 25% less fuel* will be required for a given power output. Or, correspondingly more work can be done with a fixed or limited fuel supply.
4. A single, surprisingly simple control permits instantaneous change-over to oil fuel or vice versa *at continuous full load.*
5. Fluctuating or insufficient gas supply may be compensated for by the simultaneous use of both fuels in any desired proportion, readily controlled.
6. Gas-oil proportion or complete fuel change-over may be *automatically* controlled to conform exactly with fuel supply and load requirements.



Control end of Cooper-Bessemer 675 hp Type JS diesel showing simple gas-oil mechanism, operation and use of which is diagrammed below.



Engineers and operating officials in many industries will instantly recognize the tremendous economies and revolutionary advantages made possible by this new Cooper-Bessemer development.

THE Cooper-Bessemer CORPORATION

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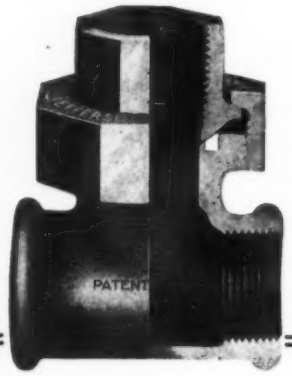
BUILDERS OF DEPENDABLE ENGINES FOR 112 YEARS



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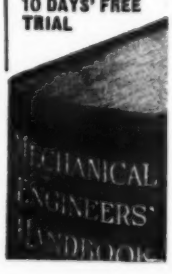

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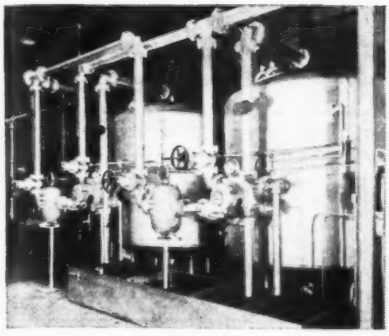
- Practical Electricity
- Hydraulics & Pumping
- Piping, Flow & Tanks
- Engineering Economics

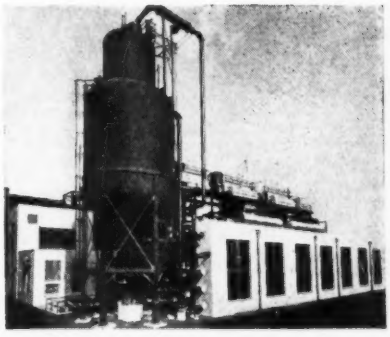
PART 2
(Feb. Power, 1944)

- Feedwater Chemistry
- Fuels & Combustion
- Steam Generation
- Turbines & Engines
- Diesels, Gas Engines
- Compressors & Fans
- Refrigeration Facts
- Heating, Air Conditioning

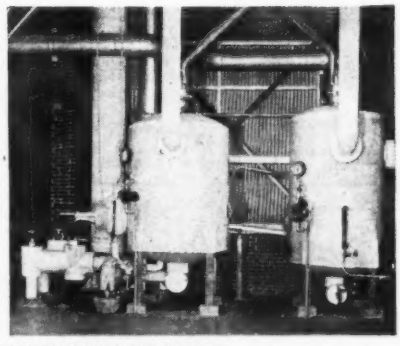
"WHAT A LINE-UP TO KEEP BOILERS ON THE LINE!"



PERMUTIT ZEO-KARB* H—Removes both hardness and bicarbonates from water. Effluent contains no encrustants, is reduced in total solids and alkalinity. Alkalinity can be adjusted by mixing effluents from a Zeo-Karb H unit and a sodium zeolite unit.



DEAERATING HEATER—Prevents corrosion by removing oxygen and free CO_2 from feedwater. Designed for pressures up to 100 pounds or higher, capacities to 1,400,000 pounds per hour or higher. Utilizes bled or exhaust steam.



CONTINUOUS BLOWOFF—Reduces foaming and priming. Maintains uniform concentration of salts in the boiler salines. Both high and low flash types. Heat from blowoff water is recovered by means of flash tanks and heat exchangers.

Permutit prevents boiler scale and corrosion . . .

Hardness and other impurities in feedwater spell trouble for war-strained power plants. But not if they're Permutit*-equipped! Permutit *removes* the impurities before the water enters the boilers!

Permutit is the world's largest maker of water conditioning equipment. Write us about *your* water problem. Address: The Permutit Co., Dept. A3, 330 West 42nd St., New York 18, N. Y., or Permutit Co. of Canada, Ltd., Montreal.

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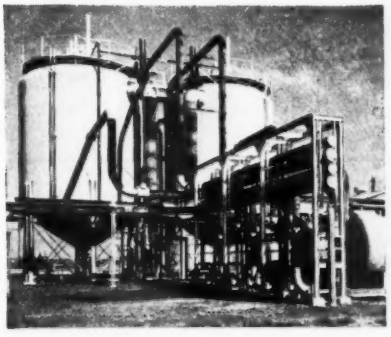
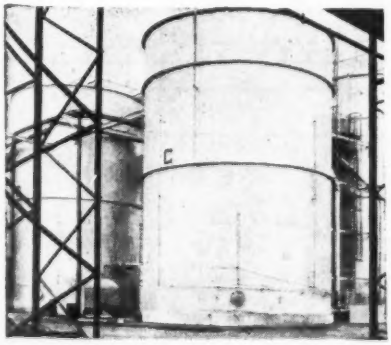


HOT LIME SODA—Lime and soda ash precipitate bulk of water hardness as calcium carbonate and magnesium hydroxide. Sludge is settled out and water filtered. Integral deaerator deaerates the water.



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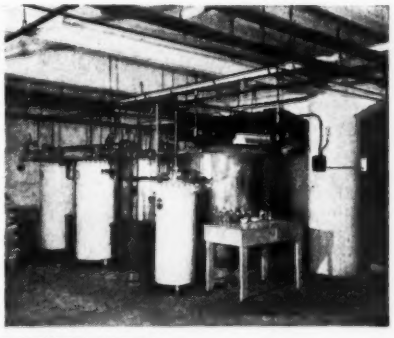
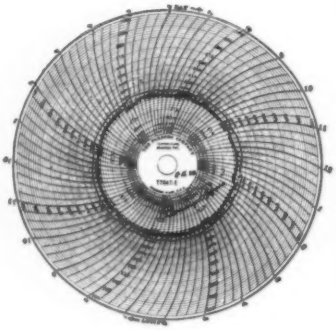
PERMUTIT



DEMINERALIZERS—By a simple process in the cold, Permutit Demineralizers produce a water practically free of salts—a low-cost substitute for evaporated water.

WATER CONDITIONING HEADQUARTERS



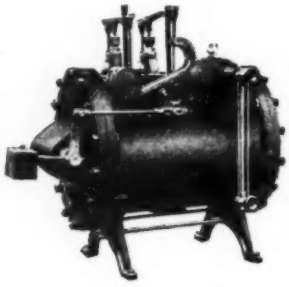
The Exclusive

Sterling

System sends high pressure condensate back to boiler-room without loss of heat or water . . .

The chart above is taken from one of the many Sterling installations. Note the average drop in condensate temperature is about 15°. And remember that every 11° rise in feed water, you save on fuel cost. Check your condensate now—chances are that it is low and you're wasting money.

SAVE FUEL NOW!



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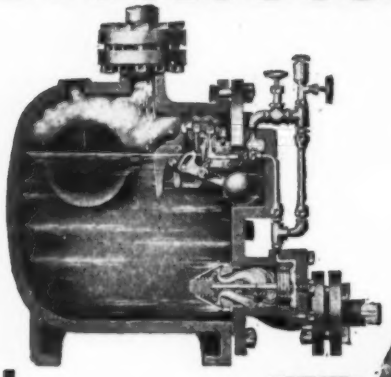

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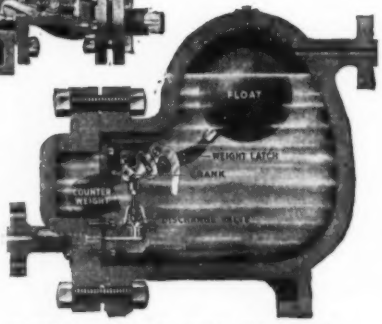
FOR

High Pressures



PISTON-OPERATED STEAM TRAP—Positive, instantaneous, for pressures to 650 lbs. Non-wire drawing discharge valve. Working parts of stainless steel. Smaller size; larger orifices; faster discharge.

WEIGHT-OPERATED TRAP (Model C)—For steam, air, gasoline; high-pressure (to 1500 lbs.). Fast, automatic, intermittent, water-sealed discharge valve; larger capacity.

Featuring exclusive designs that assure faster, positive drainage, Nicholson Steam Traps are made for nearly every power and process purpose.

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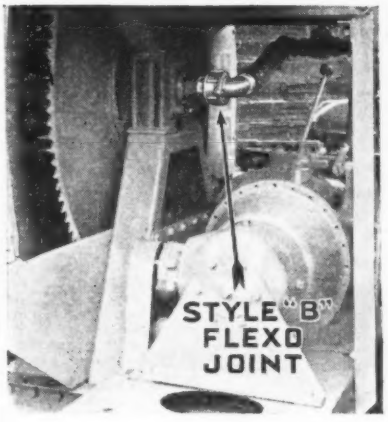


FLEXO JOINTS

Reasonable in price— extremely low maintenance cost

FLEXO JOINTS are a productive investment—their economy has been clearly proven by leading manufacturers and shows that the first cost of **FLEXO JOINTS** is quickly repaid by savings and increased efficiency. They are easily and quickly installed, have long life and low, extremely low, maintenance cost.

FLEXO JOINTS are used wherever a flexible or swing joint is required to convey steam, air, water, oil and other fluids through pipe lines that must be moved or swung in different directions or to supply machinery or equipment with any fluid while in motion.

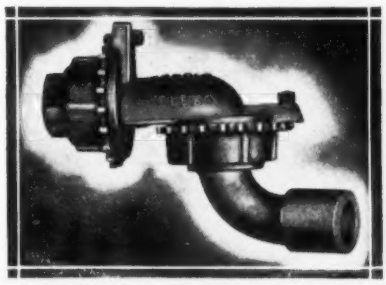
4 styles—iron pipe sizes to 3 inches for all pressures up to 1350 lbs. superheated steam.

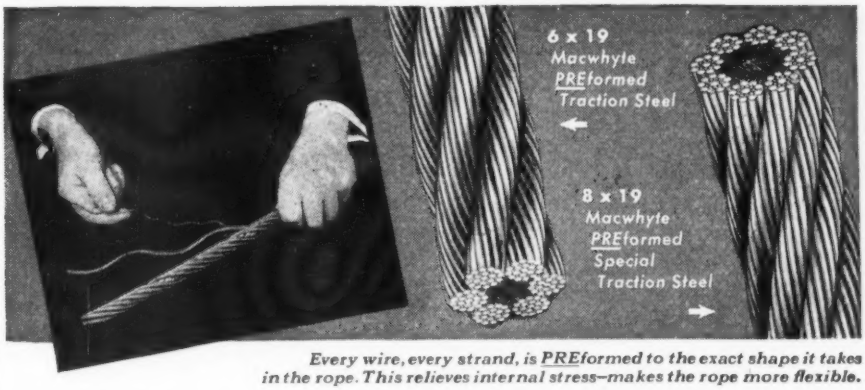
Get the details, then order from your regular supply house or direct from

FLEXO SUPPLY COMPANY Inc.
4224 Olive Str. **St. Louis (8) Mo.**
In Canada **S. A. ARMSTRONG Ltd.,**
115 Dupont Str. **Toronto (5)**

Uses for Flexo Joints—

Blower and blow-off lines in railroad roundhouses; track end connections in railroad yards and at terminals; water cooled furnace doors; calenders; steam heated presses of all kinds, vulcanizing, moulding, laundry, veneer, brick, etc.; coating rolls; gas producers; oil burners; testing blocks; revolving machinery in place of stuffing boxes; pivot pin joints on locomotive cranes; movable pipe lines in mines and quarries; steam jacketed mixers of all kinds; or any place a flexible or swing joint is required for steam, air, gas, water, oil or gasoline.





Every wire, every strand, is PREformed to the exact shape it takes in the rope. This relieves internal stress—makes the rope more flexible.

Specially Designed for Elevators

Macwhyte PREformed Elevator Ropes are made from tough, flexible wire found by years of experience to be best for elevator service. The correct lay and combination of wires are used to keep stretch at a minimum, yet make the ropes as flexible as possible to withstand bending fatigue. Flexibility is further improved by Macwhyte Internal Lubrication, which keeps individual wires and strands free to move as they bend around sheaves and drums.

MACWHYTE COMPANY
2944 Fourteenth Ave., Kenosha, Wisconsin

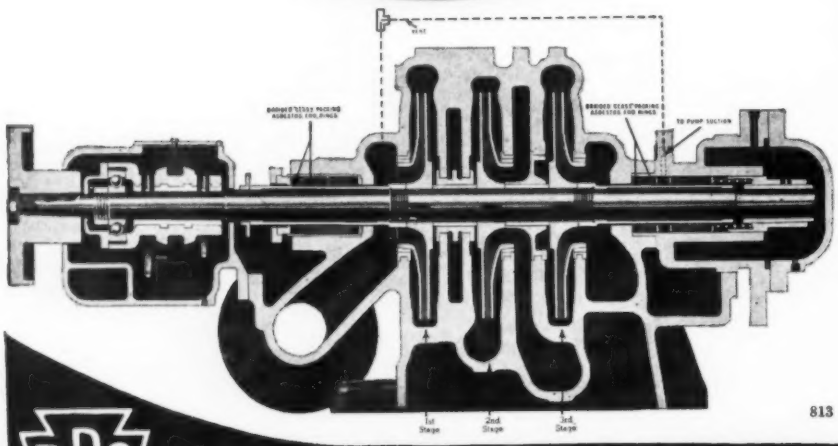
Specify Macwhyte PREformed Elevator Ropes to your maintenance man

NO. 787-E

MACWHYTE
PREformed ELEVATOR ROPES
The CORRECT Ropes for your Equipment

Pungent, obnoxious fumes arising from certain liquids, when handled at pressures requiring stage pumping, present little difficulty to users of this patented pump, constructed with submerged bearing and suitable packing.

ELIMINATED



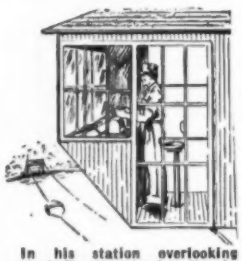
813

PPC

PENNSYLVANIA PUMP & COMPRESSOR CO.

BUSHKILL PARK ROAD, EASTON, PENNA

Large Sauerman Crescent scraper bucket ranges across pile 400 ft. wide and reclaims coal to ground hopper at rate of about 5 tons a minute.



In his station overlooking stockpile, operator has "push-button" control of entire operation of scraper, including travel of tall tower seen in background.

Increased Coal Storage Aids the War Effort

Everybody agrees that larger supplies of coal than now in sight will be required if manufacturers are to meet production demands in the coming months. Increased stockpiling now will save many headaches later.

In answer to the need, Sauerman Power Scrapers are being installed at numerous plants throughout the nation, in some cases to provide coal storage where none existed before; in others, to expand existing storage facilities at low cost. The sizes of the projects range from a few thousand tons a month to over a million tons a year.

Sauerman Equipment stores and reclaims safely, rapidly, cleanly for only a few cents per ton. Builds a homogeneous pile, practically free of combustion hazards. Operates with a minimum of champing across pile and avoids dirt and dust of heavier equipment.

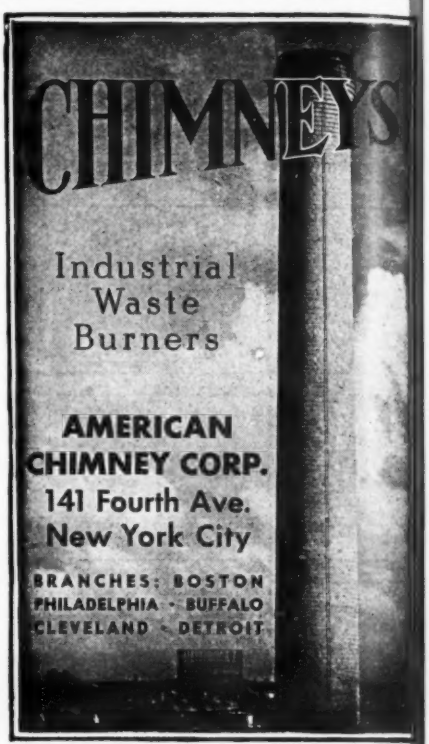
Write for Catalog.

SAUERMAN BROS., INC.

562 S. CLINTON ST. CHICAGO 7, ILL.

WHERE TO BUY

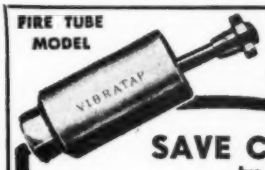
Featuring additional products and specialties for power plants



AMERICAN CHIMNEY CORP.
141 Fourth Ave.
New York City

BRANCHES: BOSTON
PHILADELPHIA · BUFFALO
CLEVELAND · DETROIT

FIRE TUBE MODEL



QUICK TUBE CLEANING

SAVE COAL
by
removing scale from boiler tubes. Use a VIBRATAP— the Vibratory Cleaner that dislodges the full thickness of the deposit and does a really complete cleaning job. Write for Bulletin K-7.

BRUNT EQUIPMENT CO.
60 S. DIVISION ST. · BUFFALO, N. Y.

THE ORIGINAL
Tripp Metallic Packing
TRIPP METALLIC PACKING CO.
BOSTON MASS.

"MONO"
BOILER BAFFLES
HIGH TEMPERATURE
Refractory Cements
BANFORD C. SMITH REFRACTORIES, INC.
1715 NIAGARA ST., BUFFALO, N. Y.

POWERS TEMPERATURE and HUMIDITY CONTROL

Automatic Control

For Industrial Processes, Heating and Air Conditioning Systems, Hot Water Heaters and Shower Baths. Write for Bulletin.

Offices in 47 Cities
2771 Greenview Ave., Chicago, Ill.

THE POWERS REGULATOR CO.

SEARCHLIGHT SECTION

POSITIONS VACANT

WANTED: EXPERIENCED draftsmen, preferably familiar with beet sugar factory design. Duration of project approximately one year. Location middle west. Give particulars as to education, experience, military status. State salary expected. References. Must have U.S.E..S. clearance. P-805, Power, 520 N. Michigan Ave., Chicago 11, Ill.

FIRE PROTECTION Engineers and inspectors. Technical graduates, especially chemical and electrical; civil, mechanical, metallurgical also considered. Inspect and consult industrial plants to prevent fires, explosions, and other casualties. Considerable travel and report writing; interesting work offering permanency. Engineering experience necessary. Salary open. Well-known national organization with openings at Cleveland, Chicago, and other district centers. Men under 30 years of age cannot be considered. Please send a photograph when applying. P-806, Power, 330 W. 42nd St., New York 18, N. Y.

MECHANICAL DRAFTSMEN and engineers experienced in steam power plant design and detailing work. State age, experience and salary desired. WMC rules apply. Write P-808, Power, 520 N. Michigan Ave., Chicago 11, Ill.

OPENING FOR an architect qualified to design industrial buildings particularly those related to the refrigeration industry. State qualifications, experience, and salary expected. Location, Wichita, Kansas. P-823, Power, 520 N. Michigan Ave., Chicago 11, Ill.

WANTED: FUEL Engineer for 12,000 H.P. High pressure boiler plant located in Northern Ohio. Technical graduate with several years experience preferred. Assume full responsibility for the selection and testing of coal. Good prospects for advancement in a long established, stable, and growing company. Liberal starting salary for qualified engineer. All replies strictly confidential. P-824, Power, 520 N. Michigan Ave., Chicago 11, Ill.

WANTED: INSTRUMENT Mechanic. Thoroughly experienced in maintenance of flow and pressure recording instruments, automatic control equipment, etc. Permanent work in large southern industrial plant. P-825, Power, 330 W. 42nd St., New York 18, N. Y.

(Continued on page 366)

WANTED

Project Engineer

Engineering and contracting firm catering to petroleum, gas, chemical and power industries needs chemical or mechanical engineers to be responsible for complete projects from flow sheets to termination of construction. Must cooperate with process engineers, drafting room, purchasing department and construction division and aggressively coordinate work through these departments. Must be proficient in thermodynamics, instrumentation and know mechanical equipment. Salary commensurate with ability. Location, Kansas City, Missouri. Applicants must have U.S.E.S. clearance.

P-821, Power

520 N. Michigan Ave., Chicago 11, Ill.

WANTED

Powerhouse Engineer

High pressure plant, 12,000 KW load, attached to large chemical manufacturing plant in Ohio. Must be technically competent and know how to handle substantial organization. Give full details in first letter. Address P-803, Power, 520 N. Michigan Avenue, Chicago, Ill.

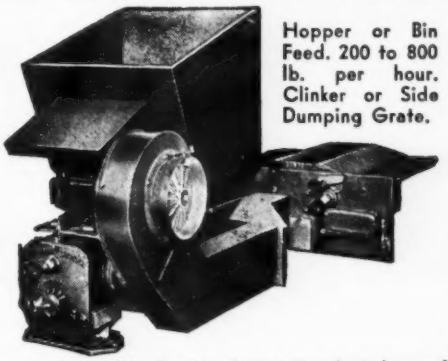
(Additional Position Vacant ads on pages 366 & 368)

3 REASONS WHY
THE *IMPROVED* FREDERICK STOKER
SAVES FUEL . . . SAVES TIME . . . SAVES MONEY

1 The fully active grate surface . . .

2 Continuous speed type transmission . . .

3 Completely enclosed windboxes and mechanism.



Hopper or Bin Feed. 200 to 800 lb. per hour. Clinker or Side Dumping Grate.

Send for our stoker catalog . . . today. Find out about Frederick engineered features which give maximum combustion efficiency with minimum service and maintenance . . . and result in lowered fuel consumption.

REMEMBER FREDERICK . . . when in the market for Centrifugal Pumps. For over 25 years Frederick has been designing and manufacturing pumps for efficient service in your industry . . . guaranteed to meet the operating conditions for which they are sold. Engineering consultation available without obligation.

THE Frederick IRON & STEEL CO.
Frederick, Maryland

STOKER SPECIALISTS SINCE 1918

For the Safety of SHIPS . . .

America needed ships . . . 50,000,000 tons of cargo, tanker and transport ships, in addition to a vast fleet of Naval vessels—*and all of these ships needed safety valves, relief valves, and pressure gauges!*

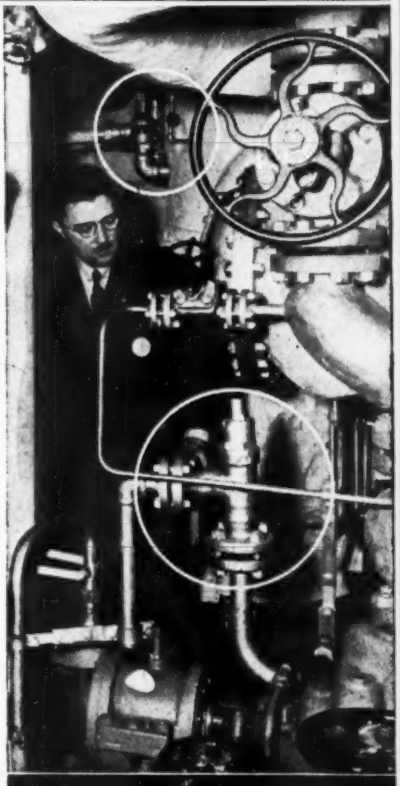
Where did all these valves and gauges come from? Lonergan produced a lot of them . . . thousands of tons of them . . . and did so in addition to serving many of America's other vital war industries.

The facilities and 73 years of "know-how" that made possible this production achievement are at your service whenever you need *Safety Valves, Relief Valves,* or *Pressure Gauges.* Get Lonergan recommendations on your next inquiry.

J. E. LONERGAN COMPANY, 2d & Race St., Phila. 6, Pa.

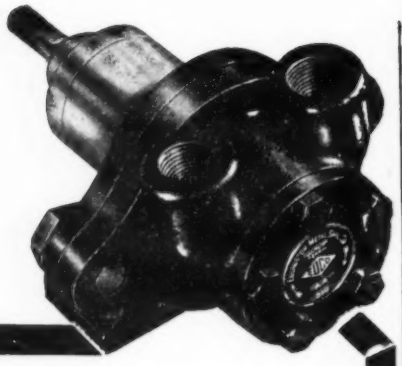
Lonergan

Safety Valves • Relief Valves • Pressure Gauges
SINCE 1872 — Makers of Pressure-Safety Appliances for the Power, Mechanical, and Process Industries



TWO OF MANY TYPES OF LONERGAN RELIEF VALVES USED ON SHIPS
OFFICIAL U. S. NAVY PHOTO

EDCO ROTARY PUMPS



VANE TYPE
PATENTED CONSTRUCTION

At high or low speeds . . . whether creating a 28" vacuum or developing extremely high pressures . . . the vanes of EDCO Pumps maintain effective spanning position without springs or centrifugal action.

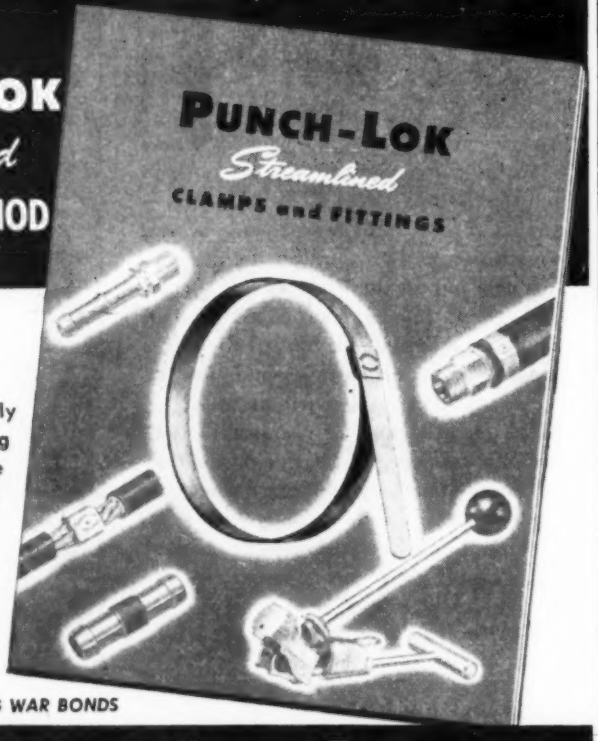
Fuel transfer pumps, coolant pumps and motor-driven assemblies. Furnished in capacities from 2 GPH up, in any required corrosion-resisting material. Operates silently at all speeds. Minimum maintenance required. Used for fuel oils and other fluids of any specific gravity.

FOR COMPLETE DATA . . . write today. Ask for Bulletin 936.

EDDINGTON METAL SPECIALTY CO.

P. O. Box K **Eddington, Pa.**

Clamp-Splice-Tie-Mend-Reinforce with PUNCH-LOK Streamlined BANDING METHOD



Punch-Lok Clamps, quickly applied with the Loking Tool, save money and time in your production and maintenance operations. Send now for descriptive catalog and name of nearest distributor.

KEEP BUYING WAR BONDS

PUNCH-LOK COMPANY

Dept. P, 321 No. Justine St., Chicago 7, Illinois

SEARCHLIGHT SECTION

CHEMISTS ENGINEERS PHYSICISTS

Men interested in careers in industrial research are urged to write us giving details of training and experience—Essential work with promising postwar future offering opportunities for professional growth.

Battelle Memorial Institute
Columbus 1, Ohio

(Continued from page 365)

EMPLOYMENT SERVICE

SALARIED POSITIONS — This advertising service of 35 years recognized standing negotiates for high salaried supervisory technical and executive positions. Procedure will be individualized to your personal requirements and will not conflict with Manpower Commission. Retaining fee protected by refund provision. Identity covered and present position protected. Send for details. R. W. Bixby, Inc., 270 Delward Bldg., Buffalo 2, N. Y.

POSITIONS WANTED

MARRIED MAN, age 50, good habits, desires position as superintendent. Twenty years experience municipal distribution, electricity, water, sewage. Three years manager R.E.A. project. Now employed, references. Write Co-Operative Manager, Box 304, Iola, Wisconsin.

POWER PLANT Chief Engineer, steam-electric wishes position in Asia, Australia, any of the larger of the South Pacific Islands or the east or northern part of South America. Will consider industrial plants in rubber, oil, sugar, textile or other industries employing medium or large power and steam generation. PW-827, Power, 330 W. 42nd St., New York 18, N. Y.

SALESMEN WANTED

ASSISTANT SALES and design engineer. Manufacturer of steam turbines and centrifugal pumps now doing essential war work but making plans for postwar operation has good opportunity for man with experience in this line. Strictly confidential. WMC rules apply. Dean Hill Pump Co., 4000 E. 16th St., Indianapolis, Indiana.

SALESMAN AVAILABLE

LATIN AMERICAN US graduate engineer 24 years experience in one of the most varied fields of power production and utilization desires position covering Latin American territory as traveling engineer for American manufacturer on salary or salary and commission. Age 45. SA-782, Power, 330 W. 42nd St., New York 18, N. Y.

Missouri refractory manufacturer has very unusual opening for Sales Correspondent and Assistant Sales Manager.
Right party can achieve notable success. In reply give age, education, experience, etc. Headquarters will be in Chicago.
SW-815, Power
520 N. Michigan Ave., Chicago 11, Ill.

SEARCHLIGHT SECTION

WANTED

SALESMAN

to manage district office of established manufacturer selling nationally advertised power plant equipment. College training, preferably in engineering, experience in power plant work or sales of power plant equipment, desirable. Age 30-35. Location Cincinnati.

SW-818, Power
520 North Michigan Ave.
Chicago 11, Ill.

EXPERIENCED

INDUSTRIAL SALESMAN

If you are over 38 with proper qualifications and seek a permanent connection with a real future with one of the country's recognized leaders in the industrial maintenance field we offer you: $50 weekly guaranteed drawing account with a contract assuring attractive income. Established territory. Nationally known line vital to war interest. No shortages or priority problems. Protection on repeat business. Our men make from $6000 to $9000 per year and more. Our products are essential because they maintain wartime plant efficiency and will be equally important after the war. The service rendered by our men is considered essential. They receive gasoline and tires needed. Write full details stating products sold for personal interview.

THE NORTH AMERICAN PRODUCTS COMPANY
Cleveland 13, Ohio

ATTENTION:

INDUSTRIAL MANUFACTURING EXECUTIVES

Inasmuch as you are interested in having enthusiastic **REPRESENTATION** for your superior products on the **WEST COAST**, it behooves you to contact a professional sales engineer, who at present is a Vice President in Charge of Sales and Engineering of a large manufacturing company, whose personal efforts and professional contributions as an author and inventor has developed unusual sales contacts of national scope. A man of integrity, outstanding ability, and gifted in the art of sales promotion—extremely aggressive and ambitious—desirous of representing reliable manufacturers as **INDUSTRIAL** or **POWER PLANT** specialist, on commission basis—office Los Angeles.

RA-816, Power
330 W. 42nd St., New York 18, N. Y.

SALES ENGINEER

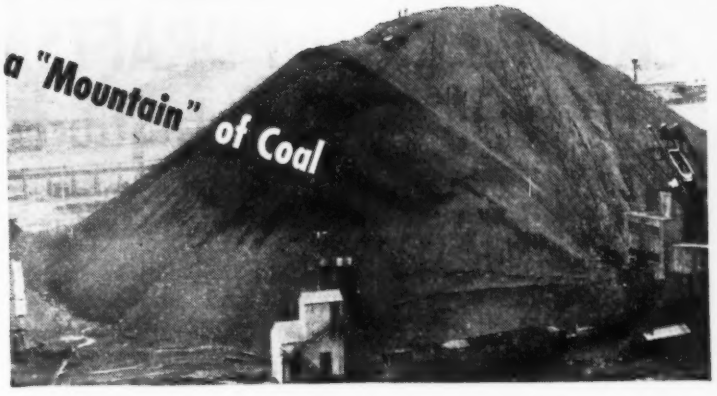
Offers to represent good line of power plant equipment on exclusive agency basis.

Has thorough experience with steam and power generating equipment and accessories. Good sales record and contacts in Metropolitan New York area.

RA-787, Power
330 W. 42nd St., New York 18, N. Y.

(Continued on page 370)
(Additional Selling Opportunity ad on page 368)

Handling a "Mountain" of Coal

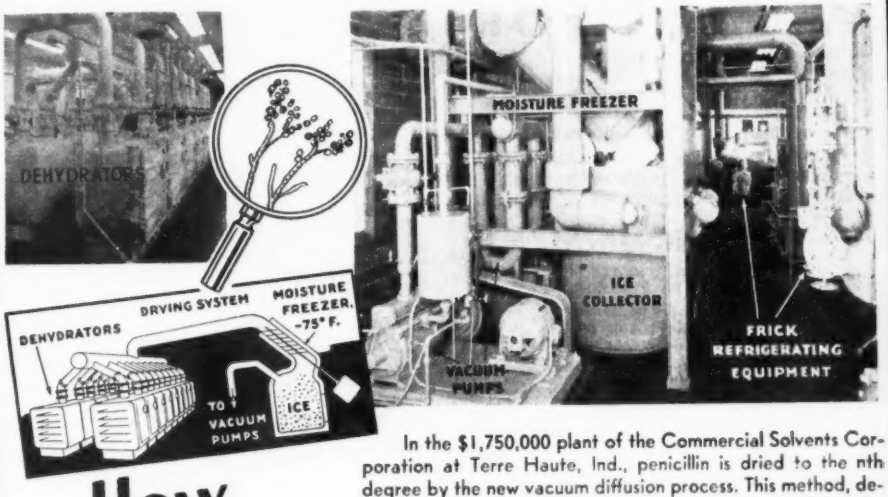


• One industrial plant increased its coal-pile depth from 48 to 116 feet, and boosted pile capacity from 39,000 to 150,000 tons in limited space. Although probably the highest coal pile in the world, fire hazard is actually reduced because pressure within the pile minimizes the air content.

To accomplish this, Beaumont engineers installed an aerial bridle system suspended from three 85' towers with the tail block position remotely controlled from the operator's station on the previously installed Beaumont cable drag scraper system.

Although your coal storage problem may not be as difficult as this one, chances are that Beaumont's 40 years' experience can save you time, trouble and money in finding the solution. Write outlining your requirements.

BEAUMONT BIRCH COMPANY
1502 RACE STREET PHILADELPHIA, PA.
DESIGNERS • MANUFACTURERS • ERECTORS OF COAL AND ASH HANDLING SYSTEMS



How Penicillin is Dried with FRICK Refrigeration

In the $1,750,000 plant of the Commercial Solvents Corporation at Terre Haute, Ind., penicillin is dried to the nth degree by the new vacuum diffusion process. This method, developed by the National Research Corporation, combines the highest vacuum ever applied to commercial drying work (one hundred-thousandth of an atmosphere) with very low temperatures (down to minus 75 deg. F.), which are maintained with Frick 2-stage Refrigeration. The striking success of this and other installations for making penicillin brought an order from our Russian Allies for four similar Frick plants for drying blood plasma.

Before you buy any commercial refrigerating, ice-making or air conditioning equipment, get in touch with your Frick Branch or Distributor. Write now for literature and estimates.

FRICK COMPANY, Waynesboro, Penna., U.S.A.

ENGINEERS and DRAFTSMEN

Electrical—Mechanical—Structural

We have openings for capable engineers and draftsmen in the following branches of engineering—

ELECTRICAL—Industrial lighting, Power distribution, and Electronic controls and devices.

MECHANICAL—Power plants, Heating systems, Process piping, Conveying systems, Plumbing, Sewers, Sprinkler work, and Precision machine design.

STRUCTURAL—Industrial buildings, Power plants, and Miscellaneous structures of steel and reinforced concrete.

Opportunities are in the West Coast, Cleveland, Chicago, New York and Gulf Coast areas.—Vital war plants important to the United States Government under high priority ratings.—Recent graduates will be considered.

Applicants must conform with Local War Manpower Regulations.

THE AUSTIN COMPANY

National Headquarters

16112 EUCLID AVENUE **CLEVELAND, OHIO**

FOR SALE BY OWNER

EQUIPMENT POWER PLANT

TURBO GENERATOR

1—500 KW General Electric condensing generator exciter on shaft, water rate 15.5 per KW hour.

BOILERS

2—600 HP B&W 200# Pressure.

2—1000 HP B and W 225# pressure.

Also smaller B & W 200# Boilers.

TRANSFORMERS

1—15000 KVA. 13,800-27,600 to 4150-2400 volts with taps, oil cooled.

Number of smaller sizes.

We buy complete plants outright

WHAT HAVE YOU FOR SALE?

HOWE BROTHERS

324-328 Pearl St., New York, N. Y.

TEL. WORTH 2-2708 - 2709 - 2710

ARE YOU REPRESENTED IN NEW ENGLAND?

Established New England Firm handling equipment for power and manufacturing plants and marine trade desires additional Line.

RA-819, Power
330 W. 42nd St., New York 18, N. Y.

WE BUY FOR C A $ H

SEND LISTINGS AND PRICES

TRANSFORMERS CONTROLS
MOTORS MOTOR GEN. SETS
AIR OIL CIRCUIT BREAKERS

POWER EQUIPMENT COMPANY

156 Andrews St., Rochester 4, N. Y.
Telephone Main 568 or 569

Offered Subject to Prior Sale

300 H.P. McIntosh-Seymour Diesel Electric Generating unit, 3 Cyl., 4 Cycle air injection Direct Connected to G.E. Type TRE, Form D.S. Generator, 2300 volts, 3 phase, 60 cycle, also direct connected exciter. Immediately available in Central Kansas.

165 H.P. Busch Sulzer Diesel Electric Generating Unit, 4 Cyl., 4 Cycle air injection Direct Connected to G.E. Type TRE generator, 3 phase, 60 cycle, 2300 volts. Shaft extension for exciter, but no exciter. Immediately available in Southwestern Kansas.

E. M. PATCHEN, *Purchasing Agent*

THE KANSAS POWER COMPANY
Great Bend, Kansas

Direct Current Diesel Plant

3—BUDA-LANOVA DIESEL GENERATING SETS Model 6-LD909, 5¼ x 7, 6 cylinder, 4 cycle, 900/1150 RPM, direct connected to: 3—55/67.5 K.W. Star Ball Bearing Generators D.C. 110/230/250 volt, type S.O. 94, compound wound.

Including fully automatic panel boards, voltage regulator, Motor generator and balancing sets, transfer pumps, etc., also 230 volt set of Philco heavy duty Batteries 420 amps hr., practically new. This is one of the finest and most complete plants offered in some time. May be seen in operation.

A. T. METTLER

151-55 Washington Street, Brooklyn 1, N.Y.
Main 4-3804

4—150 H.P. HRT boilers, 130# pressure.
1—208 H.P. Johnston Firebox boiler, 160# pressure.
1—502 H.P. B & W Sterling Class 0-20 ASME 200# pressure complete with Riley pulverizer.
1—175 H.P. Freeman Scotch Marine Boiler, 130# pressure.

NELSON MACHINERY COMPANY
Green Bay, Wis.
HOME OF THE "PACKERS"

WANTED

D-17000 cat or other high speed Diesel unit with or without generating equipment for electric service. Something new or near new.

PORTER ELECTRIC COMPANY
612 Third Avenue
South Minneapolis 2, Minn.

WANTED

Open Feed Water Heater

about 100 H. P.—

GRAND UNION EQUIPMENT CO. INC.

691 Broadway, New York City
Al. 4-2280

COMPLETE AC DIESEL PLANT

850 H.P. total in 3 units, 30 r.p.m.
360 H.P. in 1 unit, 360 r.p.m.
265 H.P. total in 2 units, 400 r.p.m.
also high speed sets, power units

STEPHEN A. DOUGLASS CO.
630 Fort Washington Ave. New York, N. Y.

WANTED

1—75 H.P., and 1—40 H.P. 440 V-3Ph 60 C. 4 Speed motors 1800-900-1200-600 R.P.M. or 900-450-600-300 R.P.M. State age, make, price, condition.

P.O. Box 852, LaCrosse, Wisconsin

WANTED

Hydroelectric generating plant, 750 KW, 60' head, a.c., horizontal or vertical type. Shovels (2), elec., 1½-yd.; a.c., crawler type. Locomotives, 40 & 25 ton, std. ga., steam, gas.

H. Y. SMITH CO.
828 N. Broadway, Milwaukee 2, Wis.

1-250 H. P. HRT BOILER

147# W.P. complete fittings, suspension setting.

McDERMOTT BROS. CO.
Allentown, Penna.

AIR COMPRESSOR WANTED

Will Pay Cash for 2600 Ft. Cap. or 2—900 to 1300 Ft. Electric or Diesel Driven Air Compressors.

W-817, Power
330 W. 42nd St., New York 18, N. Y.

WANTED FOR CASH

750 KW 80% P.F., 3 phase, 60 cycle, 480 or 240 volt, non-condensing turbo generator unit complete with switchboard and instruments, 175-200 lbs., 100 degree superheat and with 25 lbs. gauge back pressure. State age, serial numbers, general condition and price.

W-822, Power
520 N. Michigan Ave., Chicago 11, Ill.

FIRE UNDERWRITERS PUMP

FOR SALE

1000 GPM LeCourtenay type MB, BRAND NEW, 2-stage 370' Head, 5" suc., 6" disch. With or without power unit. No priority required.

Construction & Power Machinery, Inc.
270-23d St., Brooklyn, N. Y., Tel. So. 8-5254

HI-LIGHTS OF *Hemphill* VALUES!

YOU will find that the standards of performance, after rebuilding, established by Hemphill graduate Electrical Engineers, are as high as those of the original maker of power equipment. It takes experienced men and adequate equipment to get these results—but we do it. So today, with men who know equipment values best—it's "Hemphill for Power."

Supervised Rebuilding

The Hemphill rebuilding shops, staffed by experienced workmen, are under the supervision of Electrical Engineers, who decide what rebuilding is needed and check finished test performances.

The Hemphill SEAL OF QUALITY GUARANTEES ENGINEERED RECONDITIONING

MOTOR—3 PHASE 60 CYCLE

1—500 HP, 900 RPM, Lincoln, 440 volt, slip ring.
1—400 HP, 1200 RPM, 220 volt, Westinghouse squirrel cage
1—350 HP, 300 RPM, 440 volt, General Electric slip ring.
1—200 HP, 600 RPM, 2200 volt, G.E. sl. rg.
1—150 HP, 1800 RPM, 440 volt, General Electric, squirrel cage.
1—150 HP, 1750 RPM, Westinghouse, sl. rg.
1—150 HP, 400 RPM, 440 volt, General Electric squirrel cage.
1—125 HP, 1800 RPM, 2200 volt, Continental, squirrel cage.
1—100 HP, 1800 RPM, 440 volt, General Electric, squirrel cage.
3—100 HP, 720 RPM, 440 volt, G.E., sl. rg.
1—100 HP, 600 RPM, 440 volt, G.E., sl. rg.
2—100 HP, 450 RPM, 440 volt, G.E., sq. cg.
1— 90 HP, RPM, 550 volt, Cr. Whir. sq. cg.
1— 75 HP, 1200 RPM, 440 volt, G.E., slip ring.
1— 75 HP, 900 RPM, 4000 volt, Elec. Mach. syn.
1— 75 HP, 720 RPM, 440 volt, Westghse., slip ring.
1— 75 HP, 1200 RPM, G. E., sl. rg.
2— 75 HP, 900 RPM, G.E., sl. rg.
1— 60 HP, 1200 RPM, 220 volt, General Electric, slip ring.
1— 50 HP, 900 RPM, 440 volt, G.E., sl. rg.
1— 50 HP, 900 RPM, 440 volt, G.E., sq. cg.

MOTORS—D.C. 230 VOLTS

2—450 HP, G.E., 400 RPM, Type MPL Form 1-F.
1—250 HP, 760 RPM, Electro Dynamic.
1—150 HP, 750 RPM, Electro Dynamic.
1—150 HP, 500 RPM, General Electric, type MPC.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, G.E., 575 RPM.
1—100 HP, 625 RPM, G.E.
1— 80 HP, Crocker-Wheeler, 600 RPM, Type CMC.
1— 75 HP, G.E., 575 RPM, Type C, Sprague; with spare armature.

MOTORS—D.C. 230 VOLTS (Con't)

8—50 HP, Crocker-Wheeler, 700 RPM, Type CM.
1—50 HP, 700 RPM, Crocker-Wheeler.
1—30 HP, 750 RPM, G.E., Type RC.
1—30 HP, G.E., 750 RPM, Type RC-14, Form A.
1—30 HP, G.E., 1100 RPM, Type RC-31B, Form A-21.
1—35 HP, G.E., 650 RPM, Type RC-15.
1—30 HP, G.E., 625 RPM, Type C.
1—25 HP, Westghse., 600 RPM, Type SK.
2—25 HP, G.E., 775 RPM, Type RC-13.
1—20 HP, G.E., 800 RPM, Type RC-13, Form A.
1—15 HP, G.E., 800 RPM, Type RC-11.

MOTORS—VARIABLE SPEED 230 VOLTS

1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electro Dynamic.
1—60 HP, 500/1000 RPM, Diehl.
1—30 HP, 225/900 RPM, Crocker Wheeler.
1—30 HP, 400/1200 RPM, General Electric.
1—25 HP, Westinghouse, 650/2200 RPM, Type SK-110L.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—15 HP, 300/1200 RPM, G.E.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
3—11½ HP, 500/1500 RPM, Westinghouse.
1—10 HP, 400/1600 RPM, Westinghouse.
1— 5 HP, 600/1200 RPM, General Electric.
1— 5 HP, 450/1800 RPM, Crocker Wheeler.
1— 5 HP, 400/1600 RPM, Diehl.
1— 5 HP, 225/900 RPM, Electro Dynamic.

MOTOR GENERATOR SETS

1—75 KW, 125 volt, General Electric, squirrel cage.
1—20 KW, 600 volt, General Electric, squirrel cage induction motor.
2—15 KW, 250 volt, General Electric, squirrel cage.

TURBO GENERATORS

600 KW, Terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 430 volt, bleeder.
1—375 KVA, Westghse., non-condensing.
1—300 KW, G. E., 3 ph., 60 cy., 220 v. con.
1—200 KW, G.E., 3 ph., 60 cy., 220 v. cond.
1— 30 KW, 135 volt, Allis-Chalmers non-condenser.

ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, G.E.
1—250 KVA, 720 RPM, 2300 volt, G.E.
1—200 KVA, 3600 RPM, 240 volt, Allis-Chal.
1—62½ KVA, 3600 RPM, 220 volt, Allis-Chal.

TRANSFORMERS

2—400 KVA, G.E., 4156-250/480 v., Scott taps.
3—300 KVA, Pittsburgh 7800/440 volts.
3—150 KVA, G.E., 33000/2300/4000 Y.
2—100 KVA, General Electric 2200/220/440 volt.
3—100 KVA, Westinghouse, 11,430/250 volts.
3—100 KVA, Westinghouse, 13200/250 volts.
3— 75 KVA, Westinghouse, 2200/220/110 volt.
3— 75 KVA, G.E., 13,500-750/440 volts.
1— 75 KVA, G.E., 3 phase, 4156Y—120/208Y.
2— 50 KVA, Pbgh. 7500/15000 volts-110/220 volts.
2— 15 KVA, G.E., 2300-115/230 volts.
2—100 KVA, G.E., 2400/240/480.

GASOLINE DRIVEN DC GENERATOR SETS

2—25 KW, 125 volt.
1—30 KW, 125 volt.

It's Hemphill for Power!

J. L. HEMPHILL & CO.

Electrical Engineering and Equipment

OFFICE AND WAREHOUSE:
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NORTH BERGEN, N. J.

PHONE NEW YORK—LONGACRE 5-3227

PHONE NEW JERSEY—UNION 3-2600

Below BERGER OFFERS

Rebuilt and Sold with a Standard New Guarantee

ONLY PARTIAL LIST

TRANSFORMERS

1—200 KVA GE, type H.K. 2300/115/230 volts. 1 PH. 60 cy.
2—200 KVA GE, type H Form VD 4800/2400/480 volts. 1 PH. 25 cy.
1—100 KVA GE, type H Form KDD 11000/2600 volt. 1 PH. 60 cy.
2—75 KVA West. type S.K. 1 ph. 25 cy. 60000 volts Prim—6900/2300 volts secondary.
3—75 KVA Gen. Elect. K.S. 1 ph. 60 cy. 2300/115/230 volts.

OTHER SIZES VOLTAGE AND CYCLES AVAILABLE

ALTERNATORS

250 K.W.—(312 KVA) Gen.-Elect., Type A.T.I.—2300/4600 volt, 60 cycle 150 R.P.M. P. F. .08 with belted exciter.
240 KW, 8 PF Electric Machinery, 4600 volts, 60 cycle, 3 phase, 450 R.P.M. with direct connected exciter.
200 K.W. Westh. Unity Power Factor. 3 PH, 60 cyc. 220/440 900 R.P.M. with direct connected exciter.
150 KVA Westinghouse, 3 phase, 60 cycle, 2300 volts, 600 R.P.M. Revolving field with direct connected exciter.
150 KVA Gen. Elec. Type ATB form D, 60, 3 ph., 220/440 600 with Rev. Field, and built in Exc.

MOTOR GENERATOR SETS

Western Elect. 1000 Amps—40 volts direct con. to either AC or DC 580 RPM Motor.

FREQUENCY CHANGERS

30 K.V.A. Gen. Elect. type I.T.T. frame 526 P.F. 08—220/440 volts 3 Ph. 60 cy. to 240 volts 120 cycle Motor KT frame 526—3 Ph. 60 cy. 220/440 volts 1800 RPM.

ALL SIZES VOLTAGES AND CYCLES

3 ph. 25 cy. Motors

H.P.	Make	Type	Speed	Volt
350	Gen. Elec.	Sl. Rg. 3 Brg	375	400
200	Lincoln	S. R.	I. X. W.	500	440
100	Wagner	Sl Rg.	BR	750	220/440
50	Wagner	Sq. C.		500	220/440

3 ph. 60 cy. A. C. Motors

H.P.	Make	Type	Speed	Volts
200	West.	Syn.-Dir. Con. Ex.	P. F. 08	900	220/440
200	Gen. Elec.	Syn.	ATI	514	4000/2300
200	Weghse.	Syn	Dir. Con. Exc.	600	2300
150	Burke	Sq. Cg.	3 Bg. 2 Ph.	900	220/440
25	Gen. Elec.	Sq. Cg.	I. K. Vert.	720	220

230 Volt D. C. Motors

H.P.	Make	Type	Speed
85	Gen. Elec.	Vert. Comp. Wound	700
75	Crocker Wh.	CCM25JA	1700
60	Sprague	D — Comp. Wound	625
40	Fair. Morse	Ball BRG. Vert. Comp	1740

125 Volt D. C. Motors

H.P.	Make	Type	Speed
60	Allis Chalmers	FB131-Comp.	1755

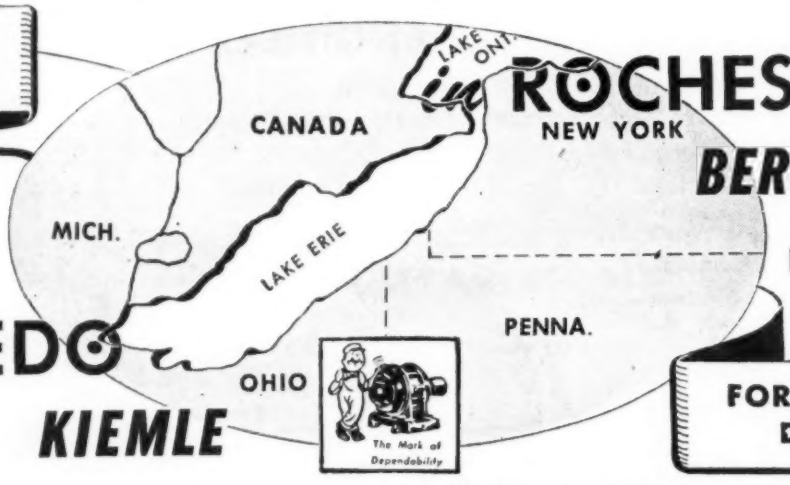
550 Volt D. C. Motors

H.P.	Make	Type	Speed
35	West.	SK150 Shunt Int.	850

D. C. GENERATORS

150 KW Western Elec. 3 brg. 3 wire. 115/230 V. 600 R.P.M.
50 KW—Northern—Comp. 110 V.—700 R.P.M.

OVER 10,000 STOCK ITEMS



THE FRED W.
KIEMLE CO.
33 N. SUPERIOR ST.
TOLEDO 4 OHIO

in TOLEDO

KIEMLE

in ROCHESTER
NEW YORK

BERGER

BERGER BROTHERS
ELECTRIC MOTORS, Inc.
395 STATE ST.
ROCHESTER 4
NEW YORK

FOR IMMEDIATE DELIVERY

TRANSFORMERS

3—500 KVA, GE, type H, form VD525 19100-22000/40000Y to 2300 1 phase 25 cycle.
1—350 KVA, GE, type H-K.D.D. 2300/460—1 PH, 60 Cy.
1—200 KVA Maloney type H.E. 2400/120/240 volts, 1 phase 60 cycle.
3—75 KVA Pitts. 1 Ph. 60 cy. 2300/230/115 volts.

OTHER SIZES, VOLTAGE AND CYCLES AVAILABLE

ALTERNATORS

10 K.W. Gen. Elect. 1 Ph. 60 Cy. 220 Volts—1800 R.P.M.

300 KW Gen. Elect. Synchronous Converter, 6 Phase, type HCC form J, 25 cycle 750 speed with transformers for 2300 volts to 230 volts D.C.

WEST. D.C.—VARIABLE SPEED MOTORS

10—10 H.P. Type S.K. 230 V. 500/1500 R.P.M. with Automatic Dynamic Braking Starters and Field Rheos.

3 ph. 60 cy. A. C. Motors

H.P.	Make		Type	Speed	Volts
200	Weghse.	Sl. Rg.	CW	500	220/440
150	Gen. Elec.	Sq. Cg.	I.K.	600	2300
100	Gen. Elec.	S. C.	K.T.	720	440
100	Gen. Elec.	S. C.	KT553	1150	440
100	Lincoln		M	1150	440
100	Gen. Elec.	R	MT	600	440

3 ph. 25 cy. Motors

H.P.	Make		Type	Speed	Volts
150	Gen. Elec.	S. R.	IM	500	440
100	Allis Ch.	S. R.		750	440
75	Gen. Elec.	Var.	BTA	375/750	440
75	Gen. Elec.	S. R.	I. M. 17B	160	440
75	Gen. Elec.	Sl. Rg.	I. M.	750	220/440

230 Volt D. C. Motors

H.P.	Make	Type	Speed
150	West.	SK 180L Comp. Wd. Int.	1150
100	Northwestern	K30 Comp. Inter.	1750
75	West	SK 150 Shunt	1200
50	Crocker Wheeler	CM	825

MOTOR GENERATOR SETS

Gen.-Elect—100 KW. 2 brg. 125 volts D.C. Comp WD-Int. with 220/440 volts, Sq. Cg. Motor.

Rebuilt and Sold with a Standard New Guarantee

Put all idle equipment to work. Send your list for prompt action. WRITE OR WIRE YOUR INQUIRIES

Above KIEMLE OFFERS

REMEMBER "U.E.M." FOR THE FINEST IN POWER PLANT MACHINERY

Units listed available for immediate delivery

TWO COMPLETE POWER PLANT INSTALLATIONS

1 1000 KW 80% P.F.—1250 KVA, 3 phase, 60 cycle, 240 volt, 3600 RPM Elliott alternating current generator direct connected to a 1000 KW, 3600 RPM, 175 to 300 lbs. pressure straight condensing having bleeder opening for 7600 lbs. steam per hour and 10 lbs. extraction pressure, complete with exciter, switchboard panel and instruments, Elliott jet condenser, pumps, piping, valves and fittings. Installed new 1939, equivalent to new.

2 324 HP Babcock & Wilcox-Sterling water tube boilers, National code, 175 lbs. pressure complete with Taylor stokers and all auxiliaries. Excellent condition; new 1922.

2 500 KVA or 400 KW 80% P.F., Westinghouse, 3 phase, 60 cycle, 460 volts, 164 RPM alternating current generators, each direct connected to a 26"x28" Skinner horizontal Universal Unaflow, side-crank, bored-guide, left-hand poppet valve, heavy duty, full floating piston, non-condensing engine, 140 to 160 lbs. pressure, 0 to 10 lbs. gauge back pressure, complete with their exciters, switchboard panels and instruments.

3 407 HP Wickes horizontal cross drum box header type water tube boilers built under ASME and National codes, 160 lbs. pressure, each complete with stoker and all auxiliaries. Two of these boilers are set in one battery and the third in a single battery. This plant is modern in type and construction, and in first-class operative condition.

TURBINE-GENERATOR UNITS

3 phase, 60 cycle

3125 KVA G.E. 180-200 lbs. pressure, 500° TT, 2300 volts, 3600 RPM, equipped with surface condenser, condensing auxiliaries, exciter unit, switchboard with instruments (a complete installation).

1875 KVA G.E. condensing 175-200 lbs. pressure, 500° TT, 660 volts, 3600 RPM complete with condenser.

937 KVA G.E. condensing 150-175 lbs. pressure, 2300 volts, 3600 RPM with direct shaft exciter, surface condenser and auxiliaries.

780 KVA Westinghouse non-condensing 175-200 lb. pressure, 15 lb. back pressure, 480 volts, 3600 RPM, complete with switchboard.

375 KVA G.E. condensing 150-200 lb. pressure, 100° SH, 2300 volts, 3600 RPM complete with surface condenser and auxiliaries.

125 KVA Westinghouse non-condensing, 175-200 lbs. pressure, 0-10 lbs. gauge back, 240 volts with direct connected exciter and switchboard.

ENGINE-GENERATOR UNITS

Direct Current

350 KW G.E. 250 volt, 175 RPM generator, direct connected to a 28"x28" Skinner Universal Unaflow non-condensing engine.

125 KW, 125 volt, 250 RPM generator direct connected to 18" x 16" Elliott engine, 100 lb. pressure, 10 lb. back pressure, complete with switchboard.

75 KW 125 volt, 1800 RPM Westinghouse non - condensing turbine - generator unit.

75 KW 125 volt, 2400 RPM Allis Chalmers Terry non-condensing turbine-generator unit.

15 KW (3) Crocker-Wheeler, 125 volts, 410 RPM generators each direct connected to an American Blower vertical engine.

SPECIAL OFFERINGS

1690 C.F.M. 110 lb. air pressure Ingersoll-Rand steam driven air compressor 125 to 150 lbs. steam pressure.

1590 C.F.M. 100 lb. air pressure Hardie-Tynes steam driven air compressor 150 to 175 lbs. steam pressure.

500 KVA G.E. 3 phase, 60 cycle, 2300 volt, 450 RPM belted generator.

600 HP 90% P.F. 3 phase, 60 cycle, 2300 volt, 180 RPM Allis-Chalmers synchronous motor.

ENGINE-GENERATOR UNITS

3 phase, 60 cycle

Alternating Current

375 KVA Westinghouse 240 volts, 225 RPM generator direct connected to 440 HP, 4 cylinders Nordberg vertical Diesel engine.

312 KVA Elliott, 4000/2300/550 or 240 volts, 180 RPM generator direct connected to a 17"x24" Elliott Unaflow non-condensing engine, 175 lb. pressure, 6 lb. back pressure.

200 KVA General Electric 240 volts, 200 RPM generator direct connected to Skinner Unaflow engine—complete.

FREQUENCY CHANGER SETS

750 KVA Westinghouse, 3-phase, 60 cycle, 2300 volts alternating current generator direct connected to 910 HP, 3 phase, 25 cycle, 2300 volts, 300 RPM synchronous motor.

1200 KVA General Electric, 3 phase, 60 cycle, 2400 volts alternating current generator direct connecting to 1700 HP, 3 phase, 25 cycle, 2300 volt, 300 RPM synchronous motor.

Utilities Electrical Machinery Corporation

600 NATIONAL CITY BANK BLDG.
CLEVELAND, OHIO

WIRE OR PHONE
LONG DISTANCE 422

LAND

Guarantee * * * The equipment will be furnished completely and thoroughly shop reconditioned, tested and guaranteed mechanically and electrically free from inherent defects; and if operated under normal conditions, with proper care and competent supervision, we will f.o.b. our plant, New York, N. Y., correct by repair or replacement at our option defects occurring in this equipment within one year from date of shipment.

1 YEAR!

Dependable Electrical Equipment

SQUIRREL CAGE MOTORS 3 ph. 60 Cy.

Qu.	HP	Make	Type	Speed
1	200	G.E. 440 v.	IK	600
1	147	West. 25 cy.	CS	715
1	100	Al. Ch.		690
2	100	G.E. 440 v.	BTA564	375/750
1	85	G.E. 2300 v.	FT529	3600
1	75	El. Dy.	KNX505	1750
1	60	El. Dy.	DHX504	1740
1	50	G.E.	KF	3560
1	50	G.E.	KT537	1750
1	50	Star	A75	1750
1	50	West.	CCL	1150
1	50	Al. Ch.		865
1	50	West.	CS	690
1	50	Cr. Wh.		865
1	50	Burke		690
1	50	West.	CS	580
2	45	W.E.		150/900
1	40	West.	CS	1760
4	40	El. Dy.	DHX444	1760
1	40	G.E.	KT	1150
1	40	Lincoln		1150
1	35	Al. Ch.		870
1	35	Wagner		850
1	35	West.	CS	690
1	30	U. S. Vert.	CFU907	3450
2	30	West.	CS	870
1	30	Diehl		860
1	30	G.E.	KT532	860
1	30	G.E.	KT342	690
1	30	West.	CCL	690
1	25	Triumph		1750
1	25	West.	CS364	1750
1	25	Wagner 220 v.	F-W	1200
1	25	Al. Ch.		1150
1	25	West.	CS	1150
1	25	El. Dy.	KNQ444	865
2	25	G.E.	IK	865
2	25	Diehl	IS167	865
1	25	West.	MS	860
1	25	G.E.	KT332	860
1	25	Wagner 440 v.	F-W	720
1	25/12½	G.E.	445	840/405
1	20	G.E.	KT312	1740
1	20	G.E. Vert.	KT501	1750
9	20	El. Dy.	KNX364	1750
1	20	F-M	KBV12D	1150
2	20	G.E. Vert.	KT512	1150
1	20	Cr. Wh.		1150
1	20	R.&M.		1160
2	20	West.	CS	1160
1	20	G.E.	KT322	1160
2	20	Al. Ch.		860
1	20	F-M		860
1	20	Diehl		860
1	20	West.	CS566	870
1	20	G.E.	KT326	870
1	20	G.E.	IK	690
1	20	West.	CS584	690
1	20	West.	CCL	690
1	15	West.	CS324	3500
2	15	G.E.	KF	3400
1	15	Burke		1750
1	15	Wagner 220 v.	F-W	1800
21	15	El. Dy.	326	1750
1	15	Lincoln		1150
1	15	G.E. Vert.	KT502	1150
1	15	West.	CCL	1150
3	15	West.	MS	1150
1	15	West.	CS	1150
1	15	G. E. Vert.	IK	860
1	15	West.	CS	860
1	15	Wagner		860
1	15	Burke		860
1	15	Wagner 440 v.	F-W	720
1	15	G.E.	IK	580
12	15	West.	CS 445	580/1750

SQUIRREL CAGE MOTORS 2 ph. 60 cy. type

Qu.	HP	Make	Type	Speed
1	75	G.E.	IQ	1750
1	70	G.E. Synch.	AQI	1200
1	50	Lincoln		870
1	50	G.E.	IQ	870
1	50	Al. Ch.		865
1	40	G.E.	KQ342	870
1	40	Al. Ch.		870
1	40	F-M		870
1	35	Al. Ch.		870
1	30	West.	CCL	1150
3	25	G.E.	IQL	1150
1	25	West.	CCL	1150
1	20	West.	CS	1160
1	15	Wagner		1740
1	15	G.E.	KQ312	1150
1	15	F-M		890

SLIP RING MOTORS 2 & 3 ph. 60 cy.

Qu.	HP	Make	Type	Speed
1	450	G.E.	MT412	506
1	250	G.E.	IM	580
1	150	El. Dy.	New	1770
1	100	G.E.	MTC5546	860
1	100	Ideal	AV	860
1	100	G.E.	IM	690
1	100	F-M	BA	690
1	75	G.E.	IM	1160
2	75	G.E.	MT	1160
1	75	West.	HF	1160
1	75	Al. Ch.		865
1	75	Al. Ch.	ANY	575
1	65	G.E.	MTO552	585
2	60	Otis		1750
1	60	West.	CW	1150
1	60	West.	CW956A	290
1	50	G.E.	IL	870
1	50	Wagner		1150
1	40	F-M		870
1	40	West.	CW	870
1	35	Burke		690
1	30	G.E.	MQ332	870
2	30	G.E. 2200 v.	MT542	690
1	25	West.	CW	1160
2	25	Al. Ch.	ANY20G	870
1	25	Burke	EMV3	870
1	25	Howell	8RS420	870
1	25	West.	CW748	575
2	15	G.E.	MT502	1150
1	15	West.	CW	870
1	15	Cleveland	MW147	870

A. C. GENERATORS

Qu.	KW	Make	Voltage	Speed
1	150	G.E.	220/440	600
1	125	Cr. Wh.	220/440	900
1	100	West.	220/440	600
1	50	Elec. Mchy.	220/440	900
1	25	West. 1 ph.	110/220	1200

PLATER

7500 Amp. Electric Products 6/12 volt, 400 RPM. with 100 H.P. Gen. Elec. TS Syn. Motor with automatic starter

230 V. D.C. MOTORS

Qu.	HP	Make	Type	Speed
1	350	West.	SK	340/425
1	150	West.	S	600
1	75	West.	SK	750
1	60	El. Dy.	25S	450/900
1	50	G.E.	CD	1150
1	50	El Dy.		900
1	50	West.	SK150	550/1100
1	45	Diehl		850
1	40	G.E.	DLC	1050
1	40	Cr. Wh.	CCM	915
1	35	West.	SK120	975
1	35	G.E.	RLC204	440/880
2	30	G.E.	CD83	3450
1	30	West.	SA	975
1	25	G.E.	RC	1150
1	25	West.	SK	1150
1	25	Diehl	K8	850
1	25	Al. Ch.		850
1	25	El Dy.		1500
1	25	G.E.	CD113	575
1	20	G.E.	CD83	1200/1600
1	20	R. & M.		1150
1	20	G.E.	RC	1150
1	20	El. Dy.		950
1	20	G.E.	RC	800
1	20	West.	SK110L	750
1	15	Roch.	8V5	3450
3	15	G.E.	RC	1150
2	15	G.E.	CD	1150
1	15	G.E. Vert.	CD	900
1	15	West.	SK	850
1	15	G.E.	RC	850
1	15	West.	SK	600/2500
1	13	Diehl		200/247
1	10	G.E.	RF	450/1800
1	10	G.E.	RC	1150
1	10	West.	SK	400/1200
3	10	G.E.	RC	850
1	10	G.E.	CVC	700
1	10	Diehl		750
1	10	West.	SK	600/1200
1	10	El. Dy.		450/1800
1	10	G.E.	RF	400/1600
2	10	West.	SA	400/1200
1	91	G.E.	RF	450/1800
1	8½	Diehl		900
1	8½	West.	SK	850
1	8½	West.	SK90	350/1400
1	8	G.E.	RLC	500/1500
1	7½	G.E.	RC	1700
1	7½	G.E.	CVC	1525
1	7½	West.	SK	1450
3	7½	G.E.	RC	1150
2	7½	G.E.	RC	1150
1	7½	West.	SK	950
1	7½	Al. Ch.		850
1	7½	G.E.	RC	850
3	7½	G.E.	RF	600/1800
1	7½	El. Dy.		550/1650
1	7½	Watson		525/1150
2	7½	G.E.	RF	450/1800
1	7½	West.	SK	450/1600
1	7½	Al. Ch.		350/1050

110 V. D.C. Motors

Qu.	HP	Make	Type	Speed
1	90	G.E.	DLC65	900
1	30	G.E.	CD	1150
1	15	EcK		1000
1	15	El. Dy.		615/1230
1	10	El. Dy.	3S	1100
1	10	West.	SK	850
1	10	El. Dy.	7½S	425/1275
1	10	Diehl		230
1	7½	Cr. Wh.		900
1	7½	West.	SK	500
1	7½	El. Dy.	5S	450/900
3	7	El. Dy.	5S	600/1200

D.C. GENERATORS

KW	Make	Volts	Amps	Speed
300	West.	250	1200	900
250	G.E.	125	2000	720
100	West.	250	400	720
100	Al. Ch.	250	400	570
75	West.	250	300	870
50	G.E.	250	200	870
50	G.E.	125	400	1150
45	El. Prd.	6/12	7500/3750	400
40	El. Dy.	250	160	1150
30	Reliance	250	120	1750
30	West.	125	240	1160
30	El. Dy.	600	50	1150
30	Har.	60	500	1150
25	West.	125	200	1150
25	G.E.	250	100	1150
20	G.E.	125	160	1150
20	West.	250	80	1150
15	Burke	125	120	900
15	G.E.	250	60	1150
10	Al. Ch.	125	80	1150
10	G.F.	250	40	1150
7½	West.	250	30	1150
7½	G.E.	125	60	1150
5	G.E.	250	20	1150
5	West.	125	40	1150
5	G.E.	600	9	1750

15—100/125 Amp. 7½ Volt D.C. Generator 3 ph. 60 cy. 220/440 Volt Motors.

SPECIAL
Paper Mill Drive and Power Plant

625 KVA Westinghouse Geared Turbine, 150 lbs., 35 lbs. back pressure 3 ph. 60 cy. 2400 Volt .8PF also driving 300 KW West. SK 250 Volt D.C. Generator 900 RPM with 350 HP. West. SK 250 V. D.C. Motor, double end shaft, speed 0 to 600 RPM. Complete with all control and necessary Motor Generator exciters. Sell complete or any part

BLOWERS

30—New ½ H.P. No. 5½ Clarage Blowers 3 ph. 60 cy. 220/440 Volts Motors.

COOLANT PUMPS

50—New Ruthman (Gusher) Coolant pumps, with ¼ H.P. 3 ph. 60 cy. 220/440 Volt Motors.

400 Cycle Generators

3—1 KVA Holzer Cabot 3 ph. 60 cy. 220/440 V.

ROTARY CONVERTERS

15—.225 KVA Kato 32 V. D.C. to 110/60/1 ph.

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NEW YORK CITY'S LARGEST STOCK OF ELECTRICAL MACHINERY

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Branch Offices:

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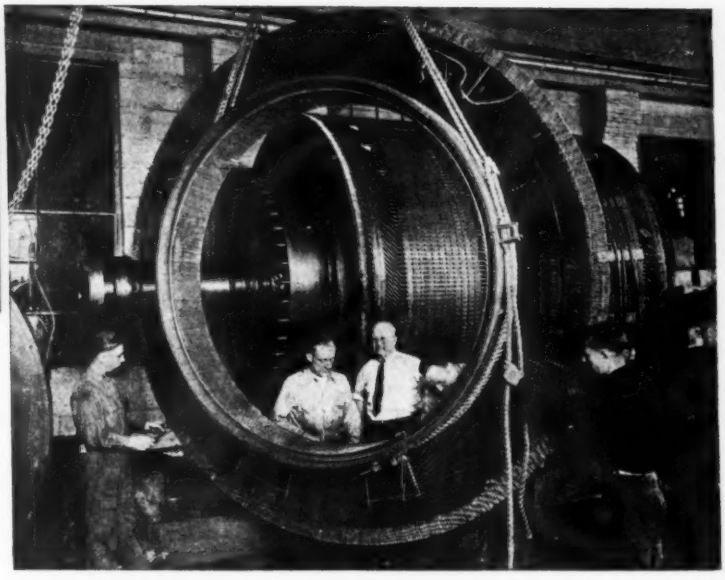
It looked OK—but it didn't satisfy Belyea inspectors!



Here's a 4000 H.P. 60 R.P.M.D.C. motor commutator with armature in background from which it was removed. On general inspection, the armature appeared 100%—BUT high potential tests by Belyea discovered weak, faulty insulation. So we put in new insulation—and today it is in active satisfactory service. Just ONE example of what Belyea "Re-Nu-Bilt" means.

You will be satisfied with this Equipment—because Belyea is!

MOTOR GENERATOR SETS

3 Phase 60 Cycle

—1500 KW G.E., 250/275 V. D.C. to 2100 H.P., 2300 V.
—1000 KW G.E., 250/275 V. D.C. to 1400 H.P., 2300/4150 V.
—1000 KW Whse., 600 V. D.C. to 2000 KVA, 2200 volt with exciter.
—750 KW G.E. 250 v. D.C. to 1100 H.P. 2300/4150 v.
—750 KW Whse., 275 V. D.C. to 1100 H.P., 220 volt with exciter.
—500 KVA—330 KW—220/440 V. A.C. Gen. to 500 H.P.—230 V. D.C. Motor.
—500 KW G.E., 600 V. D.C. to 700 H.P. 13200/6600 V.
—400 KW G.E., 250/275 V. D.C. to 650 H.P. 2300 V.
—300 KW G.E., 600 V. D.C. to 435 KVA, 2300 V.
—250 KW G.E., 275 V. D.C. to 435 KVA, 2300 V.
—200 KW G.E., 125 V. D.C. to 300 KVA, 440 V. Syn. Motor with exciter.
—75 KW G.E., 125 V. D.C. to 120 H.P., sq. cg., 2300/4000 V.
—50 KW G.E., CD, 125 V. D.C. to 75 H.P., sq. cg., 2300/4000 V.

3 Phase 25 Cycle

—25 KW G.E., 125 V. D.C. to 35 H.P., 360 V. Motor.
—75 KW Whse., 125 V. D.C. to 110 H.P., 440 V. Motor.
—250 KW G.E., 250 V. D.C. to 285 KVA, 6600 V. Motor.

TURBO GENERATOR SETS

—500 KW Whse. 625 KVA, 440 V. 3 ph. 60 cy. 3600 RPM with Parsons 145/175 lb. cond. turbine complete with jet cond. and access.
—75 KW Ridgeway 250 V. D.C. with Terry turbine 180 lbs. pressure with 12 lb. bk. pres., 2000 RPM.

FREQUENCY CHANGER

—1000 KW G.E. with 1250 Kva, .8 p.f. AQB 2300 volt 3 phase (can be changed—800 KW 3 phase) 58.3 cycle gen. and 1400 HP .8 p.f. 440/2200 volt ATI 3 phase 25 cycle motor and exciter.

A.C. MOTORS

3 Phase 60 Cycle

SLIP RING

Qu.	HP	Make	Volts	RPM	Desc.
2	100	G.E.	2200	575	IM
1	100	G.E.	550	685	MTC-5552
1	100	G.E.	550	720	IM
1	100	G.E.	220	1750	IM
3	250	Whse.	440/2300	450	CW
1	250	G.E.	4000	257	MT-424Y
1	350	G.E.	4000/2200	253	MT-442Y
1	400	G.E.	2200	252	IP
1	400	A.-C.	2300	505	ANY
1	450	Whse.	2200	875	CW
1	600	G.E.	550	220	MT
1	800	A.-C.	440	885	ANY
1	1200	C. W.	2300	237	801Q

SQUIRREL CAGE

Qu.	HP	Make	Volts	RPM	Desc.
1	100	G.E.	2300	450	IK Vert.
1	125	Whse.	550	1140	CS
1	150	Whse.	550	400	CS-594A
2	175/112	G.E.	440	900/720	IK
1	200	G.E.	2200	490	IK
1	200	G.E.	550	580	IK
1	200	G.E.	440	900	IK
1	300	G.E.	440	900	IK
1	300	Whse.	550	580	CS
1	100	West.	2200	880	CS

SYNCHRONOUS

Qu.	HP	Make	Volts	RPM	Desc.
1	75	G.E.	220	600	TS 7556
1	125	Whse.	2200	1800	
1	600	Al. Ch.	2300	720	
2	2100	G.E.	2200/4400	514	ATI

SYNCHRONOUS CONDENSERS

Qu.	Kva.	Make	Volts	Speed	Desc.
1	750	G.E.	220/440	900	ATI
1	900	G.E.	2200/6600	1200	TS
1	1000	G.E.	2300/4100	900	ATI
1	2060	Whse.	2300	720	
1	3000	Al. Ch.	2300	900	
1	5000	Whse	2300/4000	900	

3 Phase 25 cycle

1	75	Al. Ch.	440	750	ANY
1	125	G.E.	440	730	KT
1	150	G.E.	440	500	IM
1	200	G.E.	440	242	Sl. Rg.
1	300	G.E.	440	290	Sl. Rg.
1	390	G.E.	6600	750	ATI
1	1400	G.E.	2300	500	ATI

ROTARY CONVERTERS

3 Phase 60 Cycle

Qu.	KW	Make	Speed	DC V.	Trans. V.
1	1500	Whse.	720	600	2300
1	1500	Whse.	600	600	11500
1	1250	G.E.	720	250	2300
1	1000	Whse.	720	250	22000
1	1000	G.E.	900	600	13200
1	1000	Whse.	900	600	11000
2	750	G.E.	1200	600	2300
1	750	Whse.	720	250	6600/2300
1	500	Whse.	1200	600	13200/2300
2	375	G.E.	1200	250	6600/2300
2	300	G.E.	1200	600	2300

3 Phase, 25 Cycle Booster Type

2	1500	G.E.	500/225/275/13200/6600
1	500	G.E.	750/225/275/13200/6600

All units can be furnished with AC and DC controls

D.C. MOTORS

Qu.	HP	Make	Type	Volts	Speed
2	1250	G.E.	MPC	500	180
1	1200	Whse.	Int.	600	600/720
1	1200	G.E.	MPC	600	450
1	800	G.E.	MPC	550	600
1	700	G.E.	MPC	250	220/440
2	625	G.E.	MPC	500	730
1	500	Whse.	Int.	250	250/720
1	500	G.E.	MPC	230	900
1	350	G.E.	MPC	230	450
1	300	G.E.	MPC	230	275/550
1	250	Al. Ch.		230	525
1	250	G.E.	C	230	375
2	200	Whse.	SK	230	400
1	175	Whse.	SK	230	150/525
1	150	G.E.	MPC	230	250/450
2	130	Cr. Wh.	CMC-65H	550	1200
2	125	G.E.	CO-1832	230	625
1	100/150	Whse.	SK-200	550	600
1	100	G.E.	LC-50	230	1200
1	100	Whse.	SK-180	230	600
1	100	G.E.	RC-38	230	600
1	75/100	Whse.	SK-183	230	450/900
1	50/100	G.E.	MPC	230	225/450
2	75	Whse.	SK-188	230	500/1000
1	75	G.E.	C	230	500/1000
1	60	El. Dy.	258	230	525/1050
1	60	Al. Ch.	E-131	110	1750
1	50/60	Cr. Wh.	CMC-65H	230	500/1000
1	50	G.E.	RC-19	230	400/1200
1	50	Cr. Wh.	CMC-80H	230	380/750
1	15/50	Cr. Wh.	CMC-81H	230	300/900

SUCCESSFUL OPERATION GUARANTEED

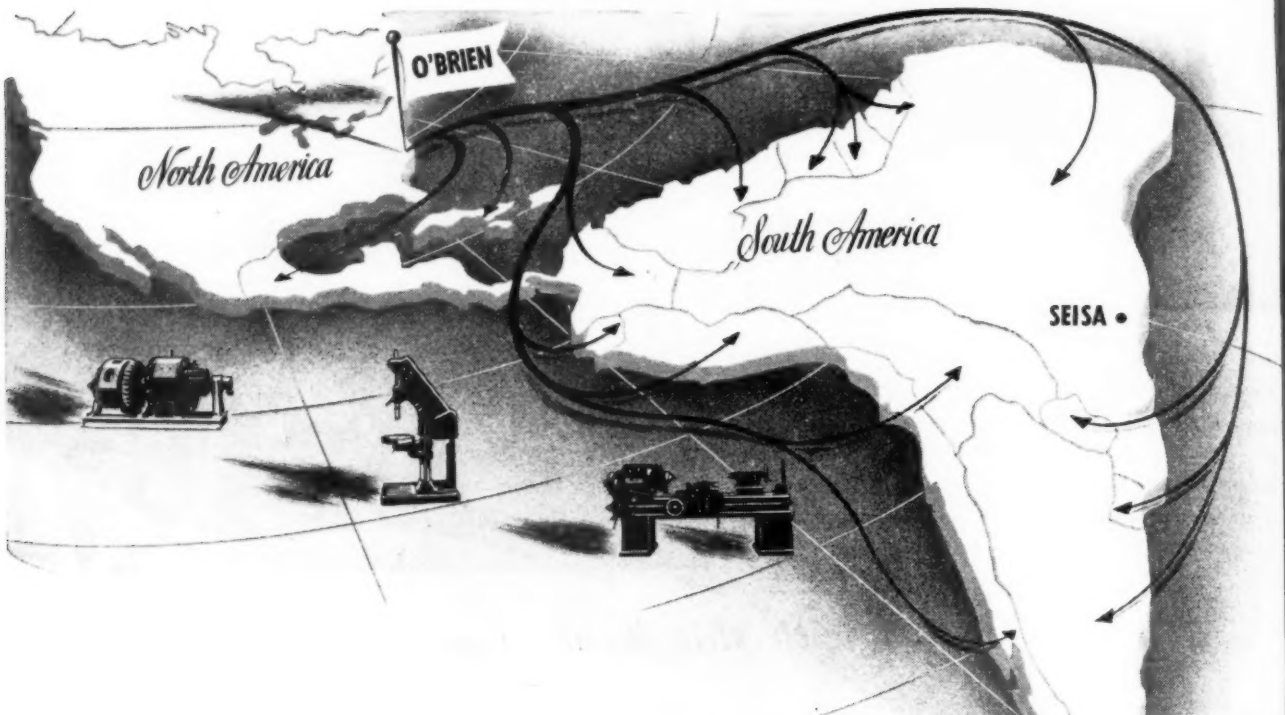
Quality without Question

BELYEA CO., INC.

Main Office and Shop

43 HOWELL ST., JERSEY CITY, N. J.

RE NU BILT BELYEA MOTORS



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NEW—USED—GUARANTEED REBUILT MACHINERY CARRIED IN STOCK FOR PROMPT SHIPMENT

POWER PLANT EQUIPMENT: Turbo Generators • Engine Generators • Diesel Engines Boilers • Blowers • Motor Generator Sets • Electric Motors • Air Compressors • Pumps Heaters • Complete Power Plants • **METAL-WORKING MACHINERY:** Machine Tools of All Kinds • Pipe Machines • Punches • Shears • Welders • Presses and Forging Equipment.

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PHILADELPHIA'S LARGEST MACHINERY DEALERS AND EXPORTERS

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POWER PLANT MACHINERY

TURBINE GENERATOR UNITS

3 phase, 60 cycle

5000 KVA General Electric condensing turbine generator unit, 2300 volts, 200 lb. steam pressure, with surface condenser

3750 KVA General Electric condensing turbine generator unit, 2300 volts, 175 lb. steam pressure, with surface condenser

2500 KVA General Electric condensing turbine generator unit, 2300 volts, 150 lb. steam pressure, with surface condenser

1560 KVA Westinghouse automatic extraction turbine generator unit, 480 volts, 150 lb. steam pressure, 15 lb. extraction, with jet condenser

1250 KVA Allis Chalmers automatic extraction turbine generator unit, 480 volts, 300 lb. steam pressure, 35 lb. extraction, with jet condenser

937 KVA General Electric condensing turbine generator unit, 2300 volts, 150 lb. steam pressure, with surface condenser

375 KVA General Electric non-condensing turbine generator unit, 600 volts, 150 lb. steam pressure, 7 lb. back pressure

312 KVA Crocker Wheeler Moore non-condensing bleeder type generator unit, 240 volts, 425 lb. steam pressure, 125 lb. bleeder pressure, 18 lb. back pressure

TURBINE GENERATOR UNITS

250 volts D. C.

500 KW General Electric Automatic extraction turbine generator unit, 250 volts, 150 lb. steam pressure, 5 lb. extraction, with surface condenser

1000 KW General Electric condensing turbine generator unit, 250 volts, 150 lb. steam pressure, with surface condenser

ENGINE GENERATOR SETS

3 phase, 60 cycle

675 KVA General Electric generator, 480 volts, direct connected to Ames uniflow engine, 150 lb. steam pressure, 5 lb. back pressure

500 KVA Crocker Wheeler generator, 2400 volts, direct connected to Chuse non-releasing Corliss engine 150 lb. steam pressure, 5 lb. back pressure

375 KVA General Electric generator, 2300 volts, direct connected to Murray uniflow engine, 150 lb. steam pressure, 8 lb. back pressure

312 KVA General Electric generator, 2300 volts, direct connected to Chuse non-releasing Corliss engine, 150 lb. steam pressure, 5 lb. back pressure

312 KVA Allis Chalmers generator, 240 volts, direct connected to Nordberg uniflow engine, 150 lb. steam pressure, 5 lb. back pressure

250 KVA General Electric generator, 2300 volts, direct connected to Chuse uniflow engine, 175 lb. steam pressure, 5 lb. back pressure

200 KVA Crocker Wheeler generator, 240 volts, direct connected to Ames vertical uniflow engine, 125 lb. steam pressure, 5 lb. back pressure

188 KVA Crocker Wheeler generator, 120/208 volts, direct connected to Skinner counterflow engine, 125 lb. steam pressure, 5 lb. back pressure

MERCURY ARC RECTIFIERS

600 volts D. C.

550 KW Brown Boveri mercury arc rectifier, with 3 phase, 60 cycle, 26,400 volt transformer and automatic control equipment

1000 KW General Electric mercury arc rectifier, with 3 phase, 60 cycle, 13,800 volt transformer and automatic control equipment

MERCURY ARC RECTIFIER

250 volts D. C.

300 KW Allis Chalmers mercury arc rectifier, with 3 phase, 60 cycle, 4150 volt transformer

DIESEL GENERATOR UNITS

3 phase, 60 cycle

375 KVA Allis Chalmers generator, 240 volts, direct connected to Nordberg diesel engine

375 KVA Ideal generator, 2300 volts, direct connected to De Lavergne diesel engine

312 KVA General Electric generator, 240 volts, direct connected to Busch-Sulzer diesel engine

300 KVA Fairbanks Morse generator, 240/2300 volts, direct connected to Fairbanks Morse diesel engine

233 KVA Fairbanks Morse generator, 480 volts, direct connected to Fairbanks Morse diesel engine

ENGINE GENERATOR UNITS

250 volts D. C.

500 KW Crocker Wheeler generator, direct connected to Ames vertical uniflow engine, 150 lb. steam pressure, 5 lb. back pressure

300 KW General Electric generator, direct connected to Skinner uniflow engine, 150 lb. steam pressure, 6 lb. back pressure

250 KW Crocker Wheeler generator, direct connected to Skinner uniflow engine, 125 lb. steam pressure, 5 lb. back pressure

ROTARY CONVERTER

600 volts D. C.

500 KW Westinghouse rotary converter, with 3 phase, 60 cycle, 33,000 volt transformer and automatic control equipment

SYNCHRONOUS MOTOR GENERATOR SET

250 volts D. C.

1000 KW General Electric type MCF generator, direct connected to 1400 H.P. General Electric ATI motor 3 phase, 60 cycle, 2300/4150 volts

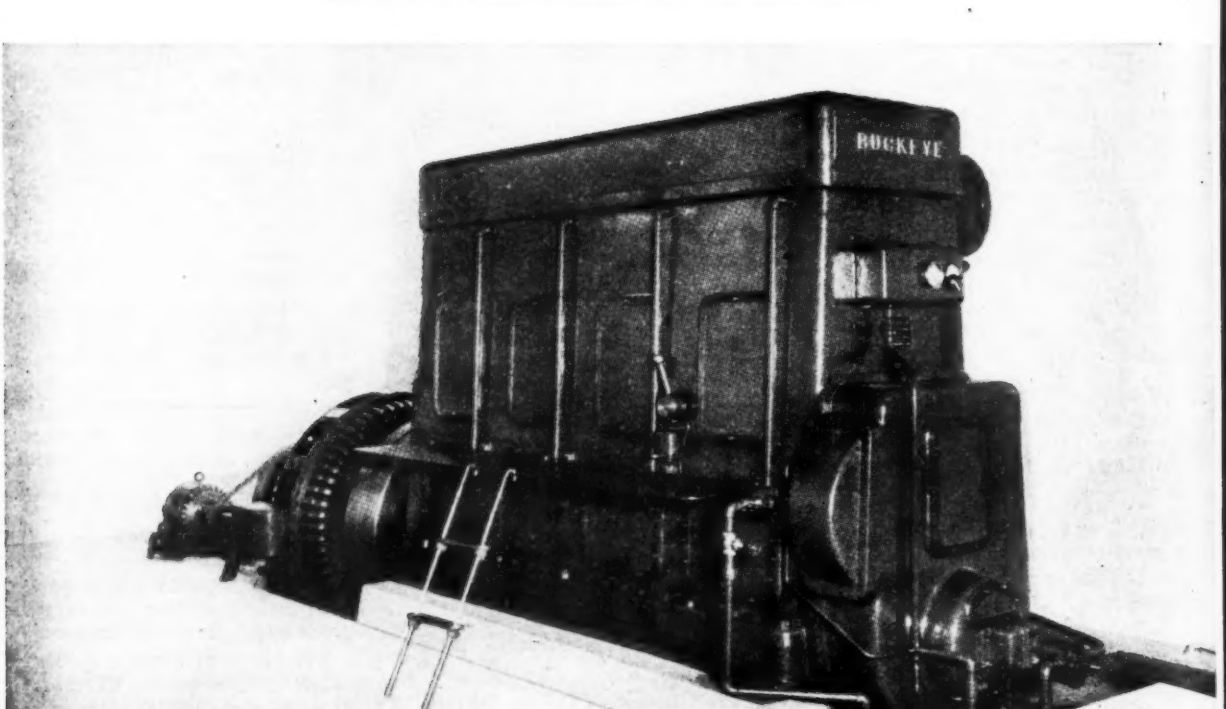
INTERNATIONAL POWER MACHINERY CO.

UNION COMMERCE BLDG. Telephone: MAin 9514 **CLEVELAND 14, OHIO**

BUCKEYE DIESELS

2500 HP — 10 UNITS

ONE OR ALL — TODAY



This unusual offering includes 10 modern units each direct connected to an alternating current generator. Complete engine auxiliaries including starting equipment, lube oil filters, fuel transfer pumps, water and oil circulating pumps, fuel oil day tanks, individual lube oil sump tanks, SILENT WATCHMEN, foundation blue prints, and spare parts. Specifications are as follows:—

1 —	675	HP	Model 0	6 cyl.	13½ x 15½	— 360	RPM D.C. to 450	KW — 1944
1 —	450	HP	Model 0	6 cyl.	13½ x 15½	— 360	RPM D.C. to 300	KW — 1938
2 —	262	HP	Model E	7 cyl.	9½ x 14	— 400	RPM D.C. to 175	KW — 1938
1 —	240	HP	Model P	3 cyl.	13½ x 18	— 300	RPM D.C. to 150	KW — 1932
3 —	150	HP	Model E	4 cyl.	9½ x 14	— 400	RPM D.C. to 125	KW — 1939
1 —	100	HP	Model J	4 cyl.	7½ x 10½	— 600	RPM D.C. to 66	KW — 1940

Running Inspection by Appointment.

ROBERT SCHOONMAKER

Port Washington, Long Island, N.Y.

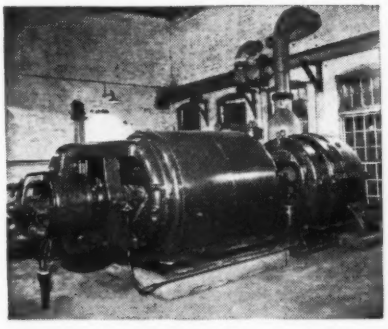
Phone Roslyn 1220

Extraordinary Liquidation

6 COMPLETE POWER PLANTS

Operated by the Georgia Power Company as recently as Dec., 1944

We are listing herewith excellent high-pressure power equipment which has just been released for sale. All this equipment has been maintained in excellent condition and is ready for immediate operation complete with all accessories. Included are all switchboards, motors, panels, transformers, motor-generator sets, exciters, automatic circuit breakers, compensators, rheostats, oil-switches, control-apparatus, pumps, blowers, heaters, piping and all auxiliary equipment. This machinery will move quickly and we urge that you arrange for immediate inspection at the premises.



GENERAL ELECTRIC 2,000 Kilowatt Turbo Generator. Actual Photo As of January 1945.

ATHENS, GA.

1—500 KW Westinghouse Turbo-Generator, 150# Steam Pressure, 2300 Volts, 3 Phase, 60 Cycle, 3600 R.P.M., with Westinghouse-LeBlanc Jet Condenser.
2—370 HP Sterling Water Tube Boilers.
2—390 HP Sterling Water Tube Boilers.
1—600 HP Babcock & Wilcox Water Tube Boiler.
1—300 KW General Electric Rotary Converter, Type HC, 8-300-900, Form P, 60 Cycles, Continuous Current, 600 Volt, 500 Amps., complete with Panel and Transformers.
1—Pawling & Harnischfeger Overhead Trolley Crane.
1—180' Steel Stack (approximate).

AMERICUS, GA.

2—375 KW Allis-Chalmers Turbo-Generators, 160# Pressure, 3600 R.P.M., 2300 Volts, 94.4 Amps., 3 Phase, 60 Cycle, with Wheeler Surface Condensers.
1—575 KW Allis-Chalmers Turbo-Generator, 160# Pressure, 2300 Volts, 157 Amps., 3 Phase, 60 Cycle, with Wheeler Surface Condenser.
1—Maris Bros. Overhead Crane.
2—200 HP Casey Hedges Water Tube Boilers, F-27-38 Foster Superheaters.
1—300 HP Heine Water Tube Boiler.
1—81' Steel Stack.

AUGUSTA, GA.

1—2750 KW General Electric Turbo-Generator, Steam Pressure, 150#, A.C. Generator, Type AQB, Class 4—Form HT, Speed 1800 R.P.M., 2300 Volts, 598 Amps., W. M. Kellogg Co. Twin Bulkley Injector Condenser.
3—400 HP Casey Hedges W T Boilers.
1—500 HP Casey Hedges Water Tube Boiler. Foster Superheater. These Boilers are Oil-Fired, system complete, Automatic Draft Control equipment, etc.

LANGSDALE, ALA.

1—2000 KW General Electric Turbo-Generator, 180# Pressure, 3600 R.P.M. Generator, Type ATB, 600 Volt A.C., 2403 Amps., with Westinghouse-LeBlanc Jet Condenser.
1—750 KW General Electric Turbo-Generator, 150# Pressure, Type ATB, Form HT, 600 Volts, 3600 R.P.M., with Westinghouse-LeBlanc Jet Condenser.
3—308 HP Heine Water Tube Boilers.
1—518 HP Heine Water Tube Boiler.
1—Overhead Trolley Crane—Maris Bros., 20 Ton.

For Further Details

TELEPHONE, WIRE OR WRITE US AT THIS OFFICE OR THAT OF OUR SOUTHERN ASSOCIATES

ATLANTA STEEL AND SUPPLY COMPANY

349 Decatur Street

Atlanta 3, Georgia

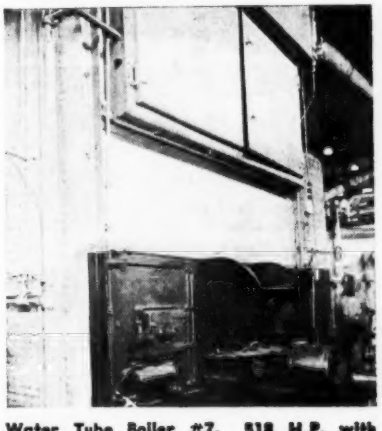
Telephone Walnut 9412 Main 4947

GRIFFIN, GA.

1—2000 KW General Electric Turbo-Generator, 2500 KVA, 6600 Volts, 219 Amps., 3600 R.P.M., Type ATB, Form HT, direct-connected Exciter with Elliott Jet Type Condenser.
1—1250 KW General Electric Turbo-Generator, Type ATB, Form HT, 3600 R.P.M., direct-connected Exciter, Wheeler Jet Condenser.
2—512 HP Babcock & Wilcox Water Tube, Sectional Type, 200# Pressure Boilers.

ALBANY, GA.

1—1000 KW General Electric Turbo-Generator, 150# Pressure, Type ATB-2, Form T, 2300 Volts, 314 Amps., 3600 R.P.M., with Worthington Barometric Condenser.
1—600 KW Westinghouse Turbo-Generator, 2300 Volts, 187 Amps., 3 Phase, 60 Cycle, 3600 R.P.M., with Worthington Barometric Condenser.
1—500 HP Sterling Water Tube Boiler.
1—250 HP Walsh & Weidner HRT Boiler.
2—250 HP R. D. Cole HRT Boilers.



Water Tube Boiler #7. 518 H.P. with Westinghouse Single Retort Underfed Stoker—200 lbs. pressure. Actual photo as of January 1945. Boiler—Heine

REPUBLIC TEXTILE EQUIPMENT COMPANY

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40 Worth Street, New York 13, N. Y. **Cortland 7-1591**

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TURBINE UNITS—60 Cy.
1—18750 KVA General Electric Cond.
2—15500 KVA Westinghouse Cond.
1—15300 KVA Westinghouse Cond.
1— 6250 KVA General Electric Cond.
1— 5000 KVA General Electric Cond.
1— 4000 KW General Electric Cond.
1— 4000 KVA Allis Chalmers Cond.
1— 3125 KVA General Electric Cond.
1— 3125 KVA Westinghouse Cond.
1— 3125 KVA General Electric Extrac.
1— 2500 KVA Westinghouse Cond.
1— 1563 KVA General Electric Cond.
1— 1563 KVA Westinghouse Extrac.
1— 750 KVA General Electric Cond.
1— 625 KVA General Electric Cond.
1— 625 KVA General Electric Non-C.
1— 250 KVA Westinghouse Non-C.
1— 125 KVA Westinghouse Non-C.

D. C. TURBO UNITS
1—1500 KW General Electric 250 V.
2—1000 KW General Electric 250 V.
1— 125 KW General Electric 125 V.
1— 75 KW General Electric 125 V.
1— 25 KW Westinghouse 125 V.

STEAM ENGINE UNITS—60 Cy.
1—1067 KVA Nordberg Uniflow
1— 375 KVA Nordberg Uniflow
1— 350 KVA Ames Uniflow
1— 325 KVA Skinner Uniflow
1— 300 KVA Hamilton 4-valve
1— 210 KVA Skinner Uniflow
1— 150 KVA Skinner Uniflow
1— 94 KVA Ridgway 4-valve
1— 93.8 KVA Skinner Uniflow

D. C. STEAM ENGINE UNITS
1—500 KW Ames Uniflow 250 V.
1—400 KW Ridgway 4-valve 275 V.
1—350 KW Ridgway Uniflow 250 V.
1—300 KW Skinner Uniflow 275 V.
1—250 KW Ames Uniflow 250 V.
1—150 KW Ridgway 4-valve 125/250 V.
1—125 KW Ridgway 4-valve 250 V. 3-wire
1—100 KW Elliott 4-valve 250 V. 3-wire

OIL & GAS ENGINE UNITS
1—625 HP Worthington, 240 V. 60 cy. gen.
1—610 HP Campbell, 2400 V. 60 cy. gen.
1—520 HP Busch Sulzer, 2400 V. 60 cy. gen.
1—450 HP M.A.N., 2300 V. 60 cy. gen.
1—440 HP Nordberg, 250 V. DC gen.
1—375 HP Worthington, 240 V. 60 cy. gen.
1—300 HP Worthington, 2300 V. 60 cy. gen.
1—300 HP McInt. & Sey., 480 V. 60 cy. gen.
1—283 HP Coop.-Bess., 230 V. 60 cy. gen.
1—175 HP Sterling (gas), 480 V. 60 cy. gen.
3—160 HP Coop.-Bess., 216 V. 60 cy. gen.
1—145 HP Superior, 220 V. 60 cy. gen.
2—125 HP Winton, 240 V. 60 cy. gen.

SURFACE CONDENSERS
1—20,000 sq. ft. Worthington
1—12,000 sq. ft. Worthington
1— 5,000 sq. ft. Westinghouse
1— 4,100 sq. ft. Ross

WATER TUBE BOILERS
1—612 HP Stirling 200-lb.
2—560 HP Erie City 460-lb.
2—512 HP Stirling 205-lb.
1—484 HP Springfield 200-lb., Oil Fired
1—481 HP Springfield 225-lb., Pulverizer
2—405 HP Erie City 160-lb., Stokers
1—404 HP Springfield 170-lb.
1—335 HP B. & W. 200-lb.
2—300 HP Heine 200-lb.
2—300 HP B. & W. 165-lb.

AIR COMPRESSORS
1—3146 Ft. 100-lb. Sullivan, 60 cy. motor
1—3093 Ft. 105-lb. Worthington, 60 cy. motor
1—2600 Ft. Sullivan, 60 cy. motor
1—2200 Ft. 100-lb. Ing. XPV, steam driven
1—1570 Ft. 100-lb. Worthington, 60 cy. motor
1—1300 Ft. 100-lb. Ing. XPV, steam driven
1—1051 Ft. Sullivan, 60 cy. motor
1—1051 Ft. Sullivan, Belted.

SYNCHRONOUS MOTORS
2—1250 HP G. E. 25 cy. 2200 V. 750 RPM
2—1125 HP G. E. 60 cy. 480 V. 720 RPM
1— 200 HP Ideal 60 cy. 4000 V. 514 RPM
1— 175 HP West. 60 cy. 4000 V. 514 RPM
1— 150 HP West. 60 cy. 2200 V. 600 RPM
1— 125 HP G. E. 60 cy. 220 V. 720 RPM
1— 100 HP G. E. 60 cy. 2300 V. 240 RPM (Super)

INDUCTION MOTORS—60 Cy.
4—3500 HP G. E. slip ring 2300 V. 120 RPM
1—2500 HP G. E. slip ring 6600 V. 253 RPM
1—1500 HP G. E. slip ring 6600 V. 253 RPM
1—1000 HP G.E. sq. cage 2300 V. 509 RPM
1—1000 HP West. slip ring 2200 V. 360 RPM
1— 500 HP G. E. slip ring 440 V. 450 RPM
2— 400 HP G. E. slip ring 3800 V. 1800 RPM
1— 300 HP G. E. sq. cage 440 V. 1800 RPM
1— 300 HP West. slip ring 440 V. 1200 RPM
3— 250 HP West. slip ring 2300 V. 720 RPM
1— 150 HP G. E. slip ring 440 V. 450 RPM
1— 100 HP G. E. sq. cage 2200 V. 900 RPM
1— 75 HP G. E. sq. cage 440 V. 514 RPM

MOTOR GEN. SETS—60 Cy.
1—1500 KW Allis Chalmers 600 V. DC
1—1000 KW General Electric 600 V. DC
1—1000 KW Westinghouse 250 V. DC
1— 300 KW Westinghouse 600 V. DC
1— 150 KW Westinghouse 250 V. DC
1— 75 KW General Electric 125 V. DC

ROTARIES—60 Cy.
2—2600 KW General Electric 250 V.
2—2500 KW Westinghouse 250 V.
2—1700 KW General Electric 250 V.
1—1500 KW Westinghouse 250 V.
2—1000 KW Westinghouse 250 V.
1— 750 KW Westinghouse 225/275 V.
1— 500 KW General Electric 250 V.
1— 500 KW General Electric 600 V.

FREQUENCY CHANGERS
2—12500 KW G.E. 60/25 cy. 300 RPM
2— 5000 KVA West. 25/60 cy. 300 RPM
2— 3125 KVA West. 25/62½ cy. 750 RPM
1— 2500 KVA West. 25/60 cy. 300 RPM
1— 1875 KVA G. E. 25/60 cy. 300 RPM
2— 1250 KVA G. E. 25/62½ cy. 750 RPM
1— 1250 KVA G. E. 25/60 cy. 300 RPM
1— 750 KVA G. E. 60/25 cy. 300 RPM

SYN. CONDENSERS—60 Cy.
1—5000 KVA West. 5000 V. 720 RPM
1—3000 KVA Al. Ch. 2200 V. 900 RPM
1—2000 KVA Elec. Mcy. 460 V. 900 RPM
2—1250 KVA G. E. 480 V. 720 RPM
1— 500 KVA West. 2200 V. 900 RPM

TRANSFORMERS—1 Ph. 60 Cy.
3— 4000 KVA West. 63.5/110-19/33 KV
4— 2500 KVA G. E. 63.5/110-19/33 KV
3— 2500 KVA Pitts. 66000-25400/12700 V.
1— 1500 KVA Pitts. 66000-33000 V. 3 ph.
3— 750 KVA Pitts. 66000-33000 V.
3— 600 KVA West. 66000-2300 V.
3— 333 KVA G. E. 66000-480 V.
3— 100 KVA G. E. 66000-6900/11000 V.
3—1667 KVA G. E. 44000-2300/4000 Y V.
4—1667 KVA Pitts. 33000-2400 V.
3— 833 KVA Al. Ch. 34460-4800/2400 V.
3— 200 KVA G. E. 33000-2300/4000 Y V.
3— 150 KVA G. E. 33000-2300 V.
3— 75 KVA G. E. 33000-13200/11000 V.
1—15000 KVA Al. Ch. 27880-4560 V. 3-ph.
2—10000 KVA West. 26400-4560 V. 3 ph.
1— 6000 KVA West. 26400-2300 V. 3 ph.
2— 1000 KVA G. E. 23000/11500-575 V.
3— 667 KVA Packard 23000-440 V.
4— 400 KVA Pitts. 22000/11000-2200 V.
3— 250 KVA G. E. 22000-11000 V.
3— 200 KVA G. E. 22000-230/460 V.
1— 6000 KVA West. 13200-2300 V. 3 ph.
1— 3000 KVA Kuhlman 13800-480 V. 3 ph.
6—1667 KVA Pitts. 13200-2300 V.
3— 1000 KVA G. E. 13200-2300 V.
3— 200 KVA G. E. 13200-480 V. Pyranol
7— 667 KVA Moloney 11000-2300 V.
3— 150 KVA Pitts. 11000-2400 V.
3— 100 KVA West. 11000-250/125 V.
3—1250 KVA G. E. 6600-550 V.
3— 150 KVA G. E. 2400-120/240 V.

VOLTAGE REGULATORS
60 Cycle Induction
1—72 KVA 300 A. 2400 V. Gen. Elec.
2—46 KVA 200 A. 2300 V. West.
6—36 KVA 150 A. 2400 V. Gen. Elec.
6—24 KVA 100 A. 2400 V. Gen. Elec.

OIL CIRCUIT BREAKERS
1— 400 A. 73 KV G. E. FKO36 Outdoor
1— 400 A. 73 KV G. E. FHKO36 Outdoor
1— 400 A. 50 KV G. E. FKO136 Outdoor
6— 400 A. 37 KV G. E. FHKO136 Outdoor
4— 400 A. 34.5 KV Condit D-16-A Outdoor
2—1000 A. 30 KV Kelman CB76 Outdoor
1— 400 A. 25 KV G. E. FKO136 Outdoor
2— 600 A. 15 KV G. E. FKO37 Outdoor
1— 600 A. 15 KV West. O-22I Outdoor
2— 400 A. 15 KV G. E. FHKO136 Outdoor
6—1200 A. 4.5 KV Condit D-12 Indoor

PARTIAL LIST—WE HAVE ALL CLASSES OF POWER EQUIPMENT

BREW, WOLTMAN & CO., INC.

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TURBO-GENERATORS

A FEW OF THE COMPLETE UNITS NOW IN OUR STOCK

1—6250—KVA. G.E. 3 60 2300V. 200#
1—3125—KVA GE 3 60 2300V. 200#
2—1875—KVA GE 3 60 2300V. 200#
1—1000—KW. DC, West. 250: 135 200#
1—1875—KVA. G.E. Non-Cond.
1—937—KVA GE Automatic Extraction 3 60 2300 V. 200 lbs.
2—937—KVA Allis-Chal. 3 60 2300:200#
1—250—KVA GE. Non-Cond. 3 60 480

Also Any Capacity or Type Desired.

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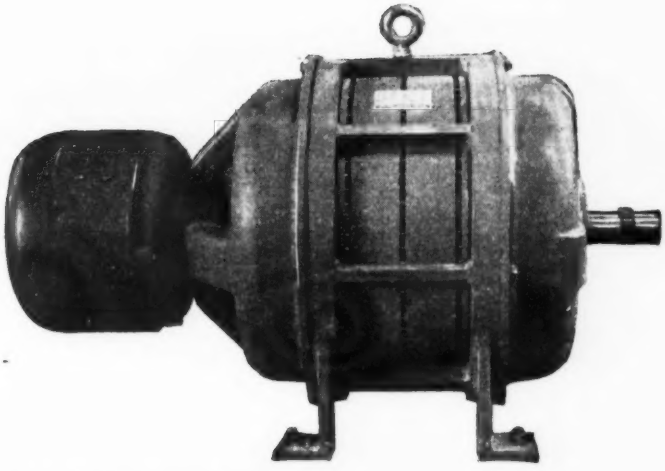
NEW GENERATORS AVAILABLE FOR . . . IMMEDIATE DELIVERY

● A limited number of Columbia and Westinghouse items . . . as listed below. Wire, Write or call Benjamin's for Motors, to-day.

75-10 KW WESTINGHOUSE A/C GENERATORS. NEW . . . 3 phase . . . 60 cycles . . . 240 volts . . . 1200 R.P.M. 80% PF Dir. Con. Exciter . . . 125 V. D. C. Ball Bearings with Ammortisseur Winding.

CAN BE RECONNECTED FOR 208-120 VOLTS

● 45-35 COLUMBIA A/C GENERATORS. NEW . . . 3 phase . . . 60 cycles . . . 240 volts . . . 1200 R.P.M. 80% PF . . . Dir. Con. Exciter . . . 125 V. D. C. Ball Bearings with Ammortisseur Winding.



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Benjamin's for Motors

ESTABLISHED 1904

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WAGNER

"Certified Rebuilt" ELECTRICAL APPARATUS

M-G SETS

150 KW Allis-Chalmers gen. DC 250 volts, coupled to 250 H.P. Gen. Elec. Synch. motor, 3-60-220/440/2200 volts.

100 KW Gen. Elec. 3 brg. unit, type RC gen. DC 125 v. coupled to 150 HP sq. cage I-K motor 3-60-2200/4000 V.

50 KW Northwestern type 6HH9 rotary converter, input 3-60-220 V., output DC 230 V. with control panel.

50 KW Cr. Wheeler type CC generator DC 125 V. coupled to 80HP C-W motor sq. cage 3-60-220/440 V. 1800 RPM.

30 KW Gen. Elec. CD 103 gen. DC 60 v. 500 amp. coupled to 45 HP G.E. KT 532 motor 3-60-220/440 v. 1160 RPM, late style 3 brg. unit.

1—20 KVA Louis Allis Type ONA b.b. rotary converter DC 230 v. to AC 3 ph. 220 v. 60 cycle 1800 RPM.

Many others available—special units built to order

D. C. MOTORS

H.P.	Mfr.	Type	Volts	Speed
100	Northw'n	interpole	230	1700
100	Reliance	1050T	230	500/1200
50	Whse.	SA	230	450/1350
40	Gen. Elec.	DLC	230	750
40	Roth	S	115	850
30	Sprague	dynamom.	250	800/2000
25	Gen. Elec.	DLC	115	750
25	Roth	elevator	230	725
25	Whse. enclosed	SK	230	600
20	Gen. Elec.	DLC	230	500/1500
20	Fair Morse	TR	230	325/700
20	Whse.	SK	230	850
20	Gen. Elec.	RC31B	230	800
15	Whse.	SK80	230	1150
15	Gen. Elec.	LC	230	550/1100
15	Gen. Elec.	CD83	230	1150
15	Whse. (6)	SK90	230	850
15	Gen. Elec.	CD95	115	575/1725

QUICK SHIPMENT FROM STOCK

SQUIRREL CAGE MOTORS

3 Phase—60 Cycles—220 or 440 Volts

Qua.	H.P.	Mfr.	Type	Speed
1	150	Whse. New b. b.	CS771.18	1800
1	150	Gen. Elec. 2200 v.	I-K	900
1	125	Allis Ch. 2200 v.	AR	1800
1	100	Gen. Elec.	I-K	720
1	75	Whse.	CCL	720
1	75	Gen. Elec.	I-K	600
1	75	Ideal	A	1200
1	60	Century	AS40	1800
3	50	Allis Ch.	AN	900
1	50	Allis Ch.	AN	720
1	40	Gen. Elec.	KT536	900
1	40	Gen. Elec.	I-K	1200
1	40	Gen. Elec.	KT332	1200
2	30	Allis Ch.	AN	1200
1	30	Allis Ch. b. v.	AR220	900
1	30	Allis Ch.	AN	600
6	30	Allis Ch.	AN	900
1	30	Whse. b. b. New	CS405	1800
2	30	Allis Ch.	AN	720
1	30	Cont. b. b.	NT365	1800
3	25	Allis Ch.	AR	1200
4	25	Allis Ch.	AN	900
1	25	Gen. Elec.	I-K	1200
1	25	Allis Ch.	AN	600
2	25	Diehl New b. b.	IN365	1800
2	25	Louis Allis b. b.	HD	1200
1	25	Whse. New	CS405	1200
6	20	Whse. New	CS364	1800
1	20	Wagner	17TBW	1800
2	20	Gen. Elec.	I-K	1200
3	20	Whse.	CS	900

25 CYCLE MOTORS

H.P.	Mfr.	Type	Speed
450	Whse. 2200 v.	CW sl. rg.	750
300	Whse.	CW sl. rg.	500
150	Whse.	HF sl. rg.	500
150	Gen. Elec. 2200 v.	MT359 sl. rg.	1600
100	Whse.	CCL sq. cg.	500
100	Gen. Elec.	I-K	750
50	Allis Ch.	ANY sl. rg.	1500
50	Allis Ch.	AN sq. cg.	750
30	Allis Ch.	sq. cage	750

SYNCHRONOUS MOTORS

H.P.	Mfr.	Type	Volts	Speed
300	Whse.	ped.	220/440	900
350	Gen. Elec. 3 brg.	ATI	220	360
250	G. E. 1-brg.	ATI	220/440	600
225	Gen. Elec.	ATI	220/440	600
150	Gen. Elec. 3 brg.	TRB	220/440	450
50	Ideal	Late	220/440	900
50	Burke		220/440	1200

CENTRIFUGAL PUMPS

14" Foster Wheeler, 5000 gpm @ 45 ft.
10" Weinman, 2500 gpm @ 40 ft.
8" Alberger, 2000 gpm @ 80 ft.
6" Platt, 1000 gpm @ 230 ft.

SLIP RING MOTORS

3 Phase—60 Cycles—220 or 440 Volts

Qua.	H.P.	Mfr	Type	Speed
1	400	G.E. 2200 v.	I-P	1200
1	350	Allis Ch.	ANY	514
1	300	Burke	EMV	225
1	200	Fair. Morse 3 brg.	BV	600
1	150	Gen. Elec.	I-M	600
2	150	Triumph	SR	514
1	100	G.E. 2200 v.	I-M	900
1	100	G.E. 2200 v.	I-E13A	1800
1	100	Gen. Elec. 3 brg.	I-M	450
1	75	G.E. 2200 v.	I-E13	1800
1	75	Gen. Elec.	MT558	600
1	75	Gen. Elec. 2200 v.	I-M	900
1	65	P. & H. b. b. Int.	CA16	900
2	60	Whse. 2200 v.	CW657	1800
3	60	Gen. Elec.	M-505	1200
1	50	Gen. Elec.	MT536	1200
1	50	Al. Ch. b. b. 2200 v.	ARY	900
1	50	Gen. Elec.	MT342	900
1	50	Gen. Elec.	I-M	600
1	40	Gen. Elec. 2 ph	MQ536	900
1	40	Northw'n	HW35A	1200
2	40	Gen. Elec.	MT532	1200
1	40	Fair. Morse b. b.	HV	900
1	40	Gen. Elec.	MT546	514
1	40	Whse.	CW	900
1	40	Watson b. b.	KHV	1200
1	35	Fair. Morse b. b.	HV	1800
2	30	Northwestern b. b.	HW404	1800
2	30	Allis Ch.	ANY	900
2	30	Whse. enclosed	MA	600

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
250	Northern		250	360
150	Allis Ch.		250	600
75	Whse.	ped.	125	600
35	Gen. Elec.	DLC	250	900
30	Lincoln b. b. 600 amp.		50	1200
25	Gen. Elec.	DLC	125	900
25	Gen. Elec.	LC	250	900
20	Gen. Elec.	RC	250	900
19	Gen. Elec. 300 amp.	CD	65	1200
16	Cr. Wheeler	CCD	125	415

ALSO IN STOCK . . . OIL SWITCHES BLOWERS & FANS . . . SPEED REDUCERS . . . 500 NEW MOTORS

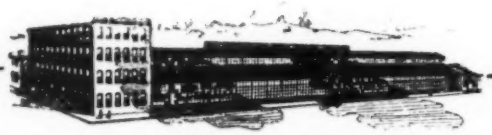
60 CYCLE A. C. GENERATORS

KVA	Mfr.	Type	Volts	Speed
500	Gen. Elec. 3 brg.	ATB	2300	450
300	Allis Ch.		240/480	600
300	Whse.	peu.	240/480	900
300	Elec. Machy.		240/480	720
250	Gen. Elec.	ATB	240/480	600
200	Gen. Elec.	TRB	240/480	720
125	Whse.	ped.	2300	600
100	Allis Ch.		240/480	900
100	Cr. Wheeler		240/480	600
50	Gen. Elec.	ATB	240/480	1200
40	Burke		240/480	1200

ARTHUR WAGNER COMPANY

1436-38 W. RANDOLPH STREET — CHICAGO 7, ILL. — MONroe 7409

IT TAKES 120,000 SQUARE FEET OF WAREHOUSE SPACE TO HOUSE OUR COMPLETE LINE OF ELECTRIC MOTORS, POWER PLANT EQUIPMENT and REBUILDING SHOPS!



IN EXCESS OF 12,000 ITEMS ARE AVAILABLE, TOO NUMEROUS TO LIST.
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THE GLOW ELECTRIC COMPANY

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TURBO GENERATORS

1—937KVA Gen. Elec. with Wheeler condensor

1—500KW Allis Chalmers Moore non-cond.

1—500KW Gen. Elec. non-cond.

1—300KW Gen. Elec. cond.

ROTARY CONVERTERS

1—1500KW 250V Westgh complete

2—1000KW 250V Westgh complete

The above are just a few of the thousands of items we have in Motors, Generators, Turbo Generators, Engine Generators, Motor Generators, transformers, Circuit Breakers, etc. Please send us your inquiries.

What have you for sale?

KEYSTONE

Power Plant Equipment Company

8403 Hegerman St., Phila. 36, Penna.

REBUILT POWER EQUIPMENT

READY TO SHIP!

SLIPRING MOTORS—3 PH., 60 Cy.

H.P.	Make	Volts	R.P.M.	Type
20	Westg.	220	1735	CW
20	Westg.	220	575	CW
25	Westg.	220	720	CW
30	Westg.	220	900	CW
40	Allis Chal.	440	860	
50	Westg.	440	1145	HF
50	Chandeys'n	220/440	1800	
50	Allis Chal.	220	490	
75	West.	220/440/2200	580/290	CW
75	G.E.	220	1200	MT
100	G.E.	220	1800	MT
100	West.	220/440	685	CW
150/75	West.	220/440/2200	580/290	CW
150	West.	2200	375	CW
150	West.	2300	490	CW
150	West.	220/440	490	CW
260	Burke	440	600	EMV-65
300	G.E.	440	900	I
400	Westg.	2300	580	CW
400	Westg.	2200	435	CW-1214
1500	Westg.	2200	435	CW

ALTERNATING CURRENT MOTORS

3 ph. 60 cy.

H.P.	Make	Volts	R.P.M.	Type
25	West.	220/440/550	1200	CS
25	G.E.	220/400	580	KF
30	G.E.	440	1800	KT
30	Linc. Elec.	220	600	
30	Triumph	220	525	TR-133
30	Allis Chal.	220/440	1200	
35	Lincoln	220	720	
40	Howell	220	900	SO
40	Linc. Elec.	220	900	
40	G.E.	440	1800	KT-527-4
40	G.E.	220/440	720	I-K
40	Triumph	440	1760	8S825
40	Lincoln	440	1800	Elev.
40	G.E.	440	900	KT
50	G.E.	220	1200	
50	G.E.	220/440	900	I-K
50	Fair Morse	220	900	
50/150	West.	2200	360/720	CS-954
50	West. El.	220	570	KT-346
50	Chandeys.	220/440	1800	
50	Cr. Wh.	240/480	1200	Syn.
50	Allis Chal.	440	1800	AN
50	G.E.	220/440	1200	HI
50	G.E.	440	1160	KT
50/32	G.E.	440	800/640	
60	G.E.	220/440	1200	I-K
60	G.E.	220	1200	
75	West.	2200/220/440	720	CS
75	West.	2300	1200	Syn.
100	Allis Chal.	220	1750	
100	Allis Chal.	220	600	
100	G.E.	440	720	I-K
125	G.E.	440	720	I-K
150	Wagner	440	1800	31V
150	G.E.	2200/220/440	450/243	
150	G.E.	440	900	I-K
175	G.E.	2200	600	I-12
200	Westg.	2200	900	
1000	G.E.	2300	509	K
1500	G.E.	2200/220/440	225	ATI-Syn.
3500/4000	West.	4000/23000	900	Syn.

VARIABLE SPEED MOTORS—230 VOLT D.C.

H.P.	Make	R.P.M.	Type
1.5	Roth	850/1700	
2¼	Westg.	450/900	SK-30
2½	G.E.	500/1000	RLC
2½	Reliance	500/1000	14T
3	Jantz-Liest	650/1950	BI-DC
3	Roth (Enclosed)	500/1000	RS
3	G.E.	400/1200	RLC-114
3¼	Westg.	400/1600	SA
3½	Westg.	850/1700	
5	Reliance	600/1800	
5	G.E.	1750	FC-33
5	Reliance	1150	
5	Reliance	1000	
7½	Westg.	450/900	80L
7½	Reliance	650/1300	550v
7½	Westg.	1125/2905	SK-43
7½	Westg.	400/1600	SA
10	Westg.	565/1130	S-6
10	G.E.	625/1250	LC
10	West.	400/1600	SA
10	G.E.	700	
10	West.	650	MT-OO
15	Louis Allis.	1150/1750	NA
15	Reliance	500/1800	
20	Westg.	750/1500	SK-110L
20	West.	600	M
25	Triumph	1200	
30	G.E.	450/900	RLC
30	West.	575	M
35	G.E.	375/1400	IC
50	G.E.	600/1200	500 v.
75	West.	475/950	SK-180
75	West.	400/650	SK-181
75	West.	1100	SK
75	West.	475	SK
80	Westg.	490	76A

TRANSFORMERS—1 ph. 60 cy.

No	KVA	Pri.	Sec.	Make
1	2	6600	110/220	G.E.
3	5	2300	220/440	G.E.
1	5	550	110	Fgh.
1	5	2200	110/220	West.
84	7½	2200	220/110	G.E.
32	7½	2200	220/110	West.
12	10	2200	220/110	West.
13	10	2200	220/110	G.E.
2	15	400/30000/50000		American
1	25	2200	220/110	G.E.
6	35	220	110	West.
3	37½	2200	440/220	West.
3	50	6600	575/440/220	G.E.
2	50	6600	550/440	Fgh.
2	50	6600	550/440	Al. Ch.
2	150	2400	240/480	Allis Chal.
6	73	2200/4000	220/110	West.
6	73	440	205	West.
1	75	2200	220	Burke
6	75	2200	220/440	West.
3	150	2400	240/480	Allis Chal.

INDUSTRIAL TRUCKS

1—Baker Tow Truck with batteries.

HOIST

1—3 ton Westinghouse Hoist with Westinghouse DC Motor, 1600 rpm.

D.C. CLARK CONTROLLER

1—250 HP Clark Vari time magnetic controller 230 v. DC reversing, used for plugging service. Can also be used non-reversing.

MOTOR GENERATOR SETS

250 volts

1—5 kw Allis Chalmers 1150 rpm Gen. dir. conn. to 220/440 v. 3 ph. 60 cy. Induction Motor.
1—7½ kw West. 1150 rpm. Gen. dir. conn. to 220/440 v. 3 ph. 60 cy. Induction Motor.
1—10 kw. West. SK 1150 rpm. Gen. dir. conn. to 220/440 v. 3 ph. 60 cy. Induction Motor.
1—15 kw. West. 1150 rpm. Gen. dir. conn. to 220/440 v. 3 ph. 60 cy. Induction Motor.
1—20 kw. West. 1150 rpm. Gen. dir. conn. to 220/440 v. 3 ph. 60 cy. Induction Motor.
1—25 kw. Triumph 1750 rpm. Gen. dir. conn. to 220/440 v. 3 ph. 60 cy. Induction Motor.
1—25 kw. West. 1150 rpm. Gen. dir. conn. to 220/440 v. 3 ph. 60 cy. Induction Motor.
1—55 KW 230 v. DC 1200 rpm. West. Gen. dir. conn. to 75 HP 1200 rpm. 2300 v. motor.
1—150 kw. West. 250 v. 900 rpm. Gen. dir. conn. to 290 HP 440 v. 3 ph. 60 cy. West. Syn. Motor.
3—250 kw. Cr. Wh. 250 v. 500 rpm. DC Gens. with 3—250 kva. Cr. Wh. Syn. 2200 v. 3 ph. 25 cy. Motors.

125 volts

1—3 kw. G.E. 1800 rpm. Gen. direct driven by 220/440 v. AC Induction Motor.
1—5 kw. 125 v. 1150 rpm. Allis Chal. Gen. dir. conn. to 3 ph. 60 cy. 220/440 v. AC Induction Motor.
1—50 kw. G.E. 1200 rpm. Gen. direct driven by 2200/440/220 v. AC Induction Motor.
1—100 kw. 125 v. West. Gen. with 2300 v. 3 ph. 60 cy. 1200 rpm. West. Syn. Motor.

500 volts

1—200 kw. West. 600 v. DC 900 rpm. Gen. dir. conn. to 290 HP 440 v. 3 ph. 60 cy. West. Syn. Motor.

A.C. GENERATORS

62½ KW Westg. 3 ph. 60 cy. 240/440/2300 v. 1200 rpm.

SPEED REDUCERS

1— 40 HP W. A. Jones 480 rpm. ratio 9.143:1.
2— 50 HP W. A. Jones 575 rpm. ratio 9.143:1.
1— 75 HP W. A. Jones 875 rpm. ratio 9.143:1.
1—100 HP W. A. Jones 1150 rpm. ratio 9.143:1.
1—125 HP Nuttal, single reduction, ratio, 1.6:1 450 rpm.
1—150 HP Nuttal, single reduction, ratio 1.6:1.
1—175 HP Jones 1750 rpm. ratio 9.143:1.
2—180 HP Cleveland size 1000 AT ratio 9-2/5:1.
1—225 Nuttal, ratio 1.6:1.
1—300 HP Nuttal, ratio 1.6:1.
1—400 HP Nuttal, ratio 1.6:1.

WRITE, WIRE OR PHONE YOUR ELECTRICAL REQUIREMENTS—SEND FOR STOCK LIST. LIST YOUR IDLE EQUIPMENT WITH US.

DUQUESNE ELECTRIC MFG. CO. Pittsburgh 6, Pa.

GOOD VALUES—Always

Fairbanks Morse Diesels, 225, 240, 280, 360, 375, 420 HP. Also generators.
McIntosh Seymour complete diesel generator sets 1000 & 300 HP, 2 or 3 phase 60 cycle, 240, 440, 600 or 2300 V.
Fulton Diesel Generators. 375 and 520 HP.
Busch Sulzer Diesels. 400 and 500 HP.
Boilers. 30 HP vertical to 800 HP in water tube types. 100 to 250 lbs. WP. 2—80 HP H.R.T. in steel encased battery. 2—260 HP H.R.T. Now being reconditioned.
Derricks. 10, 20, 50 ton Guy & Stiffleg.
Steel Sheet Piling, Pile Hammers, etc.

Mississippi Valley Equipment Co.
507 Locust St. St. Louis 1, Mo.

ELECTRICAL EQUIPMENT

FOR

INDUSTRY

LET US KNOW YOUR REQUIREMENTS

MERCURY ARC RECTIFIERS

4—300 KW 250 volts DC General Electric & Westinghouse—used 10 & 4½ months

For Details, Write

JOHN D. CRAWBUCK CO.
710 Empire Bldg., Pittsburgh 22, Pa.

POWER PLANT EQUIPMENT

Special Offerings

TURBO-GENERATORS

1—4000 KW. 2300 V. Cond.
1—2000 KW. 600 V. Cond.
1—1500 KW. 2300 V. Cond.
1—1250 KW. 480 V. Cond.
1—750 KW. 2300 V. Cond.
1—750 KW. 600 V. Cond.
1—500 KW. 125 V. D.C. Cond.
1—200 KW. 2300 V. Cond.
1—120 KW. 440 V. Von. C.
1—75 KW. 125 V. Non. C.

TURBINES ONLY

1—375 H.P. with gears
1—210 H.P. Terry 250#
1—100 H.P. G.E. with gears

ENGINE GENERATORS

1—600 KW. 2300 V.
1—125 KW. Uniflow 600 V.

BOILERS

1—2100 H.P. 350# Stoker
4—1000 H.P. 250# Oil
1—480 H.P. 225#
1—300 H.P. 225# Stoker
2—300 H.P. 160# Oil
1—200 H.P. 450# Oil
1—168 H.P. 150# Oil
1—150 H.P. 150# H.R.T.

AIR COMPRESSORS

1—6700 C.F. 22# Turbine Driven
1—1600 C.F. 50# Steam Driven
1—1315 C.F. 30# Steam Driven
1—1214 C.F. 100# Motor Driven
1—600 C.F. 350# Steam Driven
1—386 C.F. 100# Steam Driven
1—105 C.F. 350# Motor Driven

PUMPS

1—3000 GPM 65' Hd Motor
1—1000 GPM Fire Pump Steam
1—750 GPM Fire Pump Steam

CONDENSERS

1—6000 Sq. Ft. Surface
2—2212 Sq. Ft. Surface
1—3200 Sq. Ft. Surface
1—1485 Sq. Ft. Surface

Write or wire for additional data and prints.

A. LEE ELLIS CO., U. S. Mchy. Bldg., Boston, Mass.

The Buyer Must Be Satisfied—Always

CHICAGO'S LARGEST STOCK GUARANTEED EQUIPMENT

MOTOR GENERATOR SETS

KW	Make	DC	Volts	AC Volts
1200	G.E.	280	Syn.	3/60/4100
1000	G.E.	250	Syn.	3/60/4150
1000	G.E.	600	Syn.	3/60/2300
1000	Wtg.	275	Ind.	3/60/4100
750	Wtg.	275	Syn.	3/60/440
400	G.E.	250	Syn.	3/60/2300
225	Ideal	125	Syn.	3/60/2200
200	Elliott	125	Ind.	3/60/2200
150	Al. Ch.	250	Syn.	3/60/2300
100	Al. Ch.	125	Syn.	3/60/440
100	Wtg.	250	Ind.	3/60/2200
100	G.E.	250	Ind.	3/60/2200
100	G.E.	300	Syn.	3/60/440
100	G.E.	300	Ind.	3/60/440
75	G.E.	250	Ind.	3/60/440
75	G.E.	125	Syn.	3/60/220
60	Al. Ch.	110	Ind.	3/60/2200
50	G.E.	250	Ind.	3/60/440
25	G.E.	230	Ind.	3/60/220
22½	G.E.	125	Ind.	3/60/220
15	Ideal	220	Ind.	3/60/220
10	G.E.	115/230		Balancer set
7½	G.E.	60	Ind.	3/60/440
7½	Jen	115/230		Balancer set
	Roth	125/250		Balancer set
3¼	G.E.	230	Ind.	3/60/220
	Lincoln	115	Ind.	1/60/220
3	Lincoln	115	Ind.	1/60/220
3	Westg.	25	Ind.	3/60/220
2¼	Acme	45	Ind.	3/60/220
2¼	Wotton		Ind.	1/60/110/220
2.4	Lincoln	80	Ind.	3/60/220
3 HP	Roth	110	2 KVA	1/60/110
2	El Sp.	750	Ind.	3/60/440
1	Holtz. C	65		220 D.C.
5	Rob. M.	115		Variable voltage
1378	G.E.	110	Ind.	1/60/110
1350	Robbins	125	Ind.	1/60/125
1250	Rosh.	120	Ind.	1/60/110/220
12	G.E.	6		115 v. d.c.
12	G.E.	6	Ind.	1/60/110/220

FREQUENCY CHANGERS

1400 HP General Electric type ATI-24-1250M-300, form C, 3 ph., 60 cy., 460 volt, 300 RPM, 1570 amps., 1250 KVA, 0.9 P F 50° synchronous motor with amort. wdg.; dir./conn. to 1000 KW General Electric type AT-10-1250M-300, 3 ph., 25 cy., 460 volts, 300 RPM, 1570 amps., 1250 KVA, 0.8 P. F. 50° A C generator with amort. wdg., with 33 KW G.E. 125 volt direct connected exciter (This is a three brg. unit suitable for operation from either end.)

40 KW Howell, SR-5454, 3 phase, 60 cycle, 440 volt to 40 HP 3 phase, 25 cycle, 40 volt, SC-443, .8 P. F., 750 GM, 4-brg. set.

SLIPRING MOTORS

3 Phase, 60 Cycle

Qu.	HP	Make	Type	Speed
2	2500	G.E.	MT	253
1	1000	Westg.	CW	450
1	1000	Westg.	HR	360
1	1000	G.E.		400
1	850	Allis Chal.		1180
1	800	Westg.	CW	360
2	800	Westg.	CW	507
1	800	Westg.	CW	900
1	750	Allis Ch.		440
1	750	G.E.	I-P	900
1	700	G.E.	MT-10	710
1	600	Westg.	with drive	350
1	600	West.	CW	390
1	500	G.E.	MT412	435
1	500	G.E.	MT412	450
1	450	G.E.	MT412	600
1	400	Westg.	CW	435
1	400	Allis Chal.		600
1	400	G.E.	I-M	720
1	400	G.E.		1200
1	400	G.E.	IP	1800
1	350	Allis Chal.		300
1	350	G.E.	MT	300
1	350	G.E.	I-M	900
1	300	G.E.	I-24	293
1	300	Westg.	CW	400
1	300	G.E.	I-P	450
1	300	Westg.	CW	500
1	300	G.E.	I	514
1	300	G.E.		720
1	250	Westg.	CW	435
1	250	Cr. Wheeler	SR27QB	600
1	250	G.E.	IM	435
4	100	Ideal	2200	690

SQUIRREL CAGE MOTORS

3 Phase, 60 Cycle

Qu.	HP	Make	Type	Speed
1	1000	G.E. 2200 v.	K	509
1	700	G.E. 2200 drip-proof cons.	KF	1800
1	600	Fair. Morse	H2	212
1	500	G.E.	IK	1200
1	500	Westg.	CS	1750
1	400	Allis Chal.		600
1	400	G.E.	I-M	950
1	400	G.E.	I-K	1800
3	250	Westg.	CS	350
1	250	Ideal	A	1200
1	225	G.E.	I-E	1800
3	200	A.C.	AR	3600
1	200	Allis Chal.	AN	347
1	200	Fair Morse		514
1	200	Westg.	CS	600
1	200	G.E.	IK	600
1	200	G.E.	KT566	720
3	200	G.E. 2200 v.		1800
3	200	Fair Morse	BB	1800
1	200	Westg.	CS	3600
2	200	G.E.	KTP	3600
1	150	Allis Chal.		570
1	150	G.E.	IK	600
1	150	Westg.	CS	1800
2	120	G.E.		720
2	150	G.E.	I-K	720
1	150	Allis Chal.		850
1	150	G.E.	K-558	900
1	150	Westg.	CS	1800
13	75	A.C.	AR	1800

DYNAMOMETERS

250 HP GE Sprague type C dynamometer, laboratory test type 250 volts 1200/1500 RPM with Scale beam & control panel, 50 HP G.E. Sprague block test type, 275 volts, 750/2000 RPM, with complete panel.

5—25 HP GE Sprague type LC shunt interpole, block test with control panels 825/2000 RPM.

1—Type TLC-110, 250 HP, 1000/3000 RPM 250 V. BB. All Complete.

SYNCHRONOUS MOTORS

HP	Make	Volts	Speed
600	G.E.	2200	600
500	G.E.	2200	720
500	G.E.	2200	450
300	G.E.	440	900
270	G.E.	440	600
190	E.M.	440	720
150	E.M.	440	1200
5	G.E.	220	1800

PLATER

7500 ampere 6/12 volts Electric Products unit, with 100 HP GE type TS syn. motor with tank, etc.

AIR COMPRESSORS

1—6x6 Chicago Pneumatic horizontal.
1—6x6 Gardner-Quincq 60 CFM 100# horizontal.

HOISTS

3—500 lbs. Cable type, 230 volt DC motors.
1—2000 lb. Detroit rope type hoist, 3/60/220 AC.

ARC WELDERS

2—300 amp Lincoln Stable-Arc with bb motor, 3/60/220 AC
1—400 amp Lincoln stable-arc with bb motor 3/60/220 AC
1—300 amp Unaweld with 3/60/220 AC bb motor.

CHICAGO ELECTRIC CO. 1320 W. CERMAK RD. CANAL 2900 **CHICAGO 8, ILL.**

POWER PLANT EQUIPMENT CO., Inc.

39 Cortlandt Street
New York, N. Y.

A C TURBINE UNITS

6250 KVA G.E., 2300 V., cond.
3750 KVA G.E., 2300 V. cond.
3750 KVA Wghse. 600 V. BLEEDER
3125 KVA G.E., 4100/2300 V. cond.
3125 KVA G.E., 480 V., BLEEDER.
2500 KVA G.E., 2300 V. cond.
2500 KVA Al. Chal. 440 V. cond.
2500 KVA Wghse. 600 V. cond.
1875 KVA G.E., 2300 V. cond.
1553 KVA Al. Chal. 480 V. cond.
1250 KVA (2) G.E., 2300 V. cond.
937 KVA G.E. 2300 V. cond.
937 KVA (2) G.E. 2300 V. BLEEDER.
625 KVA Wghse. 2300 V. cond.
375 KVA G.E., 2300 V. cond.
312 KVA Elliott 480 V. cond.
150 KVA Wghse. 240 V. cond.

(NON COND.)

375 KVA G.E., 2300 V.
312 KVA C.W.-Moore, 450#, 240 V.
300 KVA Al. Chal. 240 V.
280 KVA E.M.-Terry.
110 KVA Al. Chal.-Elliott Kerr.
75 KVA Al. Chal. 240 V.
190 HP Wghse. 375# Turbine.
150 HP Terry, 225# Turbine.

BOILERS

850 HP B&W W. T. Boiler 250# with Riley Stoker.
728 HP Erie City, Ver. 200#.
612 HP Sterling 250# Chain Gr. Stoker.
522 HP Kidwell 207# 3 drum.
480 HP (2) Springfield 225#.
471 HP Erie City Ver., 160#.
396 HP B. & W., 160#.
328 HP Sterling (4) 160#.
300 HP (2) Union Iron Wks. Cross drum 175#.
287 HP (2) B&W 160#.
259 HP (3) Wicks ver.; 160# pulver.

DIESEL ENGINE SETS

375 KVA Wghse.—Busch Sulzer.
312 KVA G.E.—Anderson.
300 KVA Fairbanks-Morse "VA".
219 KVA Burke—Buckeye.
200 KVA G.E.—Busch Sulzer.
125 KVA Ideal Primm.
118 KVA (2) Ideal—Winton.
105 KVA Ideal Primm.
90 KVA (4) F.M.—F.M. "VA".
75 KVA Al. Chal.—International.
65 KVA F.M.—F.M. "VA".

SPECIALS

300 KVA Al. Chal. 3/60/240 v.—Elliott Kerr Turbo, non-cond.
300 KW G.E. 240/120 v. 3 wire dir. cur. — Skinner Uniflow Engine.
312 KVA Wghse. 3/60/550 v.—Skinner Uniflow Engine.
300 KVA Fairbanks Morse "VA". Diesel engine unit.
287 HP. (2) B&W Boilers 160#.

STEAM ENGINE SETS (A C)

480 KVA Al. Chal.—Corliss 4 V.
375 KVA G.E.—22x27 Erie Ball 4 V.
312 KVA Wghse.—21x22 Skinner Unif.
300 KVA G.E.—Ames UNIFLOW (Twin)
250 KVA G.E.—Nordberg UNIFLOW.
250 KVA Al. Chal.—Al. Chal. Corliss.
150 KVA G.E.—16x16 Skinner S.V.

PUMPS (MOTOR DRIVEN)

8000 GPM Al. Chal. 132' head
3250 GPM Morris 425' head.
1000 GPM Al. Chal. 246' head.
1000 GPM Morris 255' head.
800 GPM Al. Chal. 325' head.
725 GPM Wheeler 30' head.
700 GPM Ingersol 566' head.
420 GPM (2) Worthington 630'

STEAM ENGINE SETS 250 V.

450 KW C. W.—Nordberg Unif.
400 KW G.E.—Ridgway 4 V.
300 KW G.E.—Skinner Unif.
250 KW Allis Chalmers Corliss.
250 KW C.W.—Skinner UNIFLOW.
150 KW G.E.—Erie Ball 4 V.
100 KW G.E.—Erie Ball 4 V.

AIR COMPRESSORS

2200 CFM Nordberg 100#. Steam and Motor Driven.
1080 CFM Nordberg—100#.
599 CFM Ingersol—100#.

SYNCHRONOUS CONDENSER

5000 KVA Wghse. 3-60-2300/4000 V.

GAS ENGINE UNITS

115 KVA Al. Chal.—Cooper Bess.
156 KVA (2) G.E.—Bruce MacBeth.

TRANSFORMERS

100 to 3333 KVA, all voltages.

MOTORS

230 VOLT DC MOTORS
Constant Speed

Qua.	H.P.	Make	Type	Speed
1	400	Al-Ch		415
1	125	Gen Elec	DLC	550
2	75	West	S-130	475
2	50	West	SK-160	565
3	40	Gen Elec	DLC	610
1	30	West	SK-140	600
2	30	Gen Elec	RC-31B	1150
1	25	West	SK-120	825
1	25	West	SK	1100
5	25	Gen Elec	RC-31	1150
5	15	West	SK	675
11	15	Gen Elec	RC	800
2	15	West	SK	825
10	15	Gen Elec	RC	1150
13	10	Gen Elec	RC	850
1	10	Gen Elec	RC-9	1150
5	10	West	SK-40	1750
1	10	Watson	AW-9B	1500
2	7½	West	SK	850
1	7½	Gen Elec	RC	850
30	7½	Cr Wh	CCM	875
1	7½	Eck	712	1750
27	5	West	SK-40	850
1	5	Starr BB	SBF-3	3600
1	2	West	SK	680
1	2	Hobart		1750
1	2	Robbins & Myers		1750
1	1	Cr Wh	CCM	600
1	1	West	CD-923	865

230 VOLT DC MOTORS
Variable Speed

Qua.	H.P.	Make	Type	Speed
1	125	Gen Elec	CL	310/ 900
1	100	West	SA	250/ 350
2	40	Gen Elec	LC	650/1300
3	30	West	SK	600/1200
1	20	Gen Elec	RF-12	400/1200
1	16–17½	West	SK	600/1200
6	15	Gen Elec	RF-10	550/1650
1	15	West	SK	400/1600
1	15	West	SA-9	300/1200
1	10	Gen Elec	RF-10A	600/1800
1	8½	West	SK	350/1400
1	7½	Gen Elec	RF	450/1800
1	7½	West	SK	400/1600
7	3	Roth Bros		500/1000
4	2½	West	SK	500/1000
20	2	Gen Elec	RLC	415/ 830
1	2	West	SK-23	700/2100

MOTOR GENERATOR SET

50 KW Westinghouse SK 150L—1200 RPM, 125 volt DC, connected to 75 H.P. CS-764, 2200 volt, 3 phase, 60 cycle, 1200 RPM motor.

SQUIRREL CAGE MOTORS
220/440 V. 3 ph. 60 cyc.

Qua.	H.P.	Make	Type	Speed
1	400	West	CS	690
1	250	Gen Elec	IK	1800
1	200	Al Ch		1800
2	150	Al Ch (2200 V.)		1185
1	100	G.E. (2200 V.)	IK	500
1	75	Al Ch		900
1	75	Al Ch		600
1	50	Al Ch		900
1	40	Reliance		860
1	30	Wagner		600
3	30	Wagner		720
1	25	Al Ch		900
1	15	Century	SCN-19	1200
1	10	Burke		900
1	10	Gen Elec	IK	1200
1	7½	Gen Elec	KT	840
2	7½	Al Ch	AN	1150
1	7½	Gen Elec	KT	1160
1	5	Gen Elec	KT	900
5	3	Imperial	224	3600
2	3	F-M	H-6	1800
1	2	Gen Elec	K	1160
1	2	Gen Elec	K	1740
1	2	Gen Elec	KT	3510
2	1½	Gen Elec	KT	1750
1	1½	Gen Elec	KT	865
3	1	Gen Elec	KT	1725
2	1	Gen Elec	KT	1100
1	1	Wagner	TRP	860

SLIP RING MOTORS

2	150	Al Ch	3 brg	600
1	7½	Gen Elec	MT	1160

SYNCHRONOUS MOTORS

1	150	Gen Elec	ATI	900
1	75	Gen Elec	ATI	900

BOILERS

4—1010 HP Heine Water Tube Boilers, 250 lbs. pressure, complete with Superheaters, Bethlehem Dahl Oil Burners, all valves, piping and fittings.

2—440 HP New Westinghouse single retort moving grate stokers, complete with hydro feed drives, blowers and all accessories. Will operate at 200% of rating. Never installed.

WRITE US ABOUT YOUR REQUIREMENTS

TURBO-CENTRIFUGAL PUMPS

1—Terry Steam driven Turbine centrifugal pump, type GF, turbine 710 HP, 145 lb. steam pressure, 60 lb. back-pressure, 3581 RPM direct connected thru Gear Unit 1000 RPM; type U Allis Chalmers Centrifugal Pump 18″ x 18″, 13,000 GPM at 170′ head, 1000 RPM.

1—Lawrence Machine 3 stage pump 550 GPM, 418′ head. With Elliott Turbine, 200 HP, 2400 RPM, 170 lbs. initial, 12 lb. back pressure.

1—Lawrence Machine 8″ Circulating Pump, with Lee Turbine, 50 HP, 2100 RPM, 150-250 lb. initial, 10 lbs. back pressure.

1—Lawrence Machine 6″ Circulating Pump, with London Steam Turbine, 40 HP, 2200 RPM, 150 lbs. initial, 10 lbs. back pressure.

2—Lawrence Machine 5 stage pump 200 GPM, 635′ head. With Lee Turbine, 85 HP, 2650 RPM, 175 lbs. initial, 10 lbs. back pressure.

CENTRIFUGAL PUMPS

1—Lecourtenay 12″ Iron Casing Motor Driven Centrifugal Pumps, type 12BT8, 5,000 GPM at 148′ H., Direct connected to G.E. 250 HP Motor, type 1E15 form K, 440, 60, 3, 1760 RPM.

6—Gould Centrifugal Pumps 270 GPM, 30′ H. Direct Driven by 5 HP A.C. Motor.

Cameron Centrifugal Purchased New 1923. Bronze fitted, mounted on common sub-base for motor drive—

1—Size 14—700 RPM 4700 GPM 35′ head 60 HP.

1—Size 14—720 RPM 5500 GPM 30′ head 75 HP.

1—Size 16—350 RPM 3500 GPM 45′ head 125 HP.

TURBO-GENERATORS

6250 KVA Westinghouse Turbo-Generator Set: Turbine 3600 RPM, 200 lbs. pressure, 125° Superheat, complete with condenser, pump and air washer Generator: 6250 KVA, 3 phase, 60 cycle, 2300 volt, 3600 RPM, with turbo-exciter and Motor Generator Exciter.

75 HP. Westinghouse Turbine, non-condensing, 200 lbs. pressure, 7200 RPM, connected thru reduction gear to 50 KW 125 volt DC Generator, 1200 RPM.

750 Ridgway Elliott—Turbo Set, mixed pressure, 1800 RPM, 230 volt DC.

Heat and Power
COMPANY
45 BOND ST. • ALGONQUIN 4-3874 • NEW YORK 12, N. Y.

SYNCH. CONVERTERS
500 KW AL-CH. 250 D.C. 2300/4000 A.C. 1200 RPM
300 KW G.E. 600 D.C. 2300/4000 A.C. 1200 RPM
150 KW G.E. 250 D.C. 2300/4000 A.C. 1200 RPM
150 KW WEST 250 D.C. 2300/4000 A.C. 1200 RPM

MOTOR GENERATORS
500 KW G.E. SYN. 250 V. 2300/4000 A.C. 900 RPM
300 KW G.E. SYN. 600 V. 2300/4000 A.C. 1200 RPM
200 KW G.E. IND. 600 V. 2300/4000 A.C. 1200 RPM

Each unit listed above is owned by us and is available now for immediate purchase.

WALLACE E. KIRK CO.
Incorporated
502 Grant Building Pittsburgh, Pa.

BOILERS
NEW and USED
All makes & sizes for prompt shipment
Special Offer
400-HP....175 lbs.
Stirling Boilers
J. F. DAVIS CO.
122 S. Michigan Ave. CHICAGO
Telephone Harrison 0755

FOR SALE
1—340 & 400 KVA Gens. D/C 4-Valve Engs.
1—135 & 240 KVA Gens. D/C Diesel Engs.
1—200 & 30 KW Belted A.C. Generators
1—600 HP Syn. & 100 HP Sq. Cage Motors
1—50 KVA Ridgway Gen. D/C Steam Eng.
1—750, 180, 176 & 150 HP Full Diesels
1—600 & 300 HP, 200# W. T. Boilers
1—60 KW, 250 V. DC Gen. D/C Engine
H. & P. MACHINERY CO.
6719 Etzel, St. Louis

BOILERS
2—255 H.P. Heine W.T., A.S.M.E. 165#.
2—210 H.P. Heine W.T., A.S.M.E. 165#.
Complete with Enco oil burning equipment, pumps, heaters, etc.

STOKER
Huber overfeed natural draft, heavy duty. Suitable 350-500 H.P. boiler. Brand new. Immediate delivery. No priority.

M. J. HUNT'S SONS
1620 N. Delaware Ave. Phila. 25, Pa.

COMPRESSORS
Over 150 in stock
New and Guaranteed Rebuilt
Modern Plant doing Modern Rebuilding
From 50 CFM to 2500 CFM
AMERICAN AIR COMPRESSOR CORP.
Dell Ave. & 48th St., North Bergen, N. J.

SLIP RING MOTORS
3-HP., 60-CY

HP	Volts	Make	Speed
900	2200	G.E.	900
350	220/440	G.E.	1800
300	2200	G.E.	1800
300	2200	Whse.	514
300	440–220	Al. Ch.	900
250	2300	G.E.	600
250	440–550	G.E.	600
200	2200–550	G.E.	1800
200	2200–400	G.E.	600
180	440-220	G.E.	1800
150	440	G.E.	1800
150	550–2200	G.E.	1800
150	550	G.E.	720
125	2200	G.E. (NEW)	1800
125	440–220	G.E.	600
100	550–2200	G.E.	720
100	440–220	G.E.	1800
100	220–440	G.E.	720
100	220–440	G.E.	900
100	440–220	G.E. MTC	900
75	220–440	G.E.	900

SYNCHRONOUS MOTORS
3-HP., 60-CY

600	2200	Whse.	900
350	440–220	G.E.	900
300	440/220	Al. Ch.	600
200	2200	Whse.	900
110	440	Whse.	900
100	2200–550	Al. Ch.	1800
100	440–220	G.E.	360
75	440–230	G.E.	720

PUMP

1—8" Dredge Pump 1850 GPM, 120' Morris Machine Works with direct connected Slip Ring Motor 125 HP, 600 RPM, G.E.

UNAFLOW ENGINE-GENERATOR SET consisting of:
Gen: 250 KW 200 RPM 250 volt direct connected to:
Eng: 23" x 24" Ames Unaflow 125/150# ga. non-condensing.
Very modern—practically new.
1—11" x 12" Ames non-condensing Steam Engine, direct connected to a 60 KW Crocker-Wheeler 250 volt DC Generator.

TRANSFORMERS
60 CYCLE

3—500 Kva., G.E., Type H, Form KDD 13200-2300 V.
3—500 kva., G.E., type H, form KS, 13800-230/460
3—333 kva., G.E., type H-KDD 2400-400/230.
3—250 kva., Whse., 13,800-460.
3—200 kva., G.E., type H, 34500-2300 V.
1—200 kva., G.E., type HT, 13200/26400/460 V. 3 ph.
3—150 kva., G.E., type H KDD, 6600/11430Y 1300 V.
3—150 kva., G.E., type H-KDD 13200-2300.
3—150 kva., Al. Ch., type OISC 10400-2400.
3—100 kva., G.E., type H 2400-240-480.
3—100 kva., G.E., type H-KDD, 6900/11950Y-230/115.
3—100 kva., G.E., type H-KR 6600/11430Y-2300 V.
2— 75 kva., G.E., type HK, 2300-230/115.
3— 50 kva., Moloney, 2300-230/115.
6— 50 kva., Whse., type SK, 13800-240/120.
3— 50 kva., whse., 22,000-2300.

SQUIRREL CAGE MOTORS

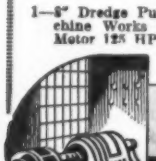
HP	Volts	Make	Type	Speed
500	440/220	G.E.	IK	1200
550	440/220	G.E.	IK	900
300	2200	G.E.	IE-K	1800
250	2200	G.E.	IK	1600
250	2200	Whse.	CS	1200
250	440/220	G.E.	IK	1800
200	220/440	G.E.	IK	720
200	440/220	G.E.	IK	900
150	440/220	G.E.	IK	900
150	2200	Allis Ch.	AN	450
150	440/220	Whse.	CS	514
125	440/220	G.E.	KT	1800
100	2200	G.E.	IK	600
100	2200	G.E.	IE-K	1800
100	550	G.E.	KT	900
100	220/440	G.E.	K1	720
75	2200	G.E.	KT	900
75	2300	G.F.	IE-K	1800
60	550	G.E.	FT	3600
50	220/400	G.E.	K	1800

MOTOR GENERATOR SETS

1—125 KW, 125 V., 1200 RPM, G. E. conn. to 175 HP, 1200 RPM, 440 V. 3 ph. 60 cy. Syn. motor.
1—75 KW, 250 V. 850 RPM, conn. to 110 HP, 440/220 V., Sq. Cage Motor.
1—50 KW, 250 V. 850 RPM, Whse. conn. to 75 HP, 440/220 V. 3 ph. 60 cy. Sq. Cage Motor.

A.C. GENERATORS

1—500 kva., 900 r.p.m., 2209 V. Whse. Condenser.
1—300 kva., 900 r.p.m., 240/480 V., G.E.
1—187 kva., 900 r.p.m., 550 V. Whse.
1—110 kva., 900 r.p.m., 440 V., G.E.
1— 96 kva., 360 r.p.m., 480/240 V. G.E.
1—62½ kva., 1200 r.p.m., 2200 V. Cr. Wh.
1— 60 kva., 720 r.p.m., 240/480 V., G.E.
1— 25 kva., 3600 r.p.m., 220 V., G.E.



STEPHEN HALL & CO.

HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

COMPLETE POWER PLANTS

STEAM—ELECTRIC—HYDRO—DIESEL

"Export Orders Carefully Executed."

SPECIAL OFFERINGS

1—2000 H.P. B. & W. 200# Boiler
4—1000 H.P. Heine 225# Boilers
2— 750 H.P. Edge Moor 200# Boilers
4— 600 H.P. B. & W. 200# Boilers
2— 600 H.P. Edge Moor 200# Stokers
1— 570 H.P. B. & W. Sectional 200#
1— 600 H.P. B. & W. Stirling 200# with Stoker
6— 440 H.P. B. & W. Sectional 200# Oil fired
1— 335 H.P. B. & W. Sectional 200 Boiler
Smaller Boilers and Fire Tube Boilers also

1—15000 K.W., G.E. Co., Turbo-Generator Condensing
1—10000 K.W., G.E. Co., Turbo-Generator Condensing
1— 5000 K.W., G.E. Co., Turbo-Generator Condensing
3— 4000 K.W., G.E. Co., Turbo-Generator Condensing
2— 2500 K.W., G.E. Co., Turbo-Generator Condensing
2— 2000 K.W., G.E. Co., Turbo-Generator Condensing
1— 2000 K.W., W. E. & M. Co., Turbo-Generator Con.
3— 1000 K.W., G.E. Co., Turbo-Generator Condensing
2— 750 K.W., G.E. Co., Turbo-Generator Condensing
Several 500 KWs. & Smaller. And Non-Cond. Units

50 Ton 69'-10" Overhead Traveling Crane.

CHARLES B. REARICK — **30 CHURCH ST.** — **NEW YORK**

POWER PLANT BARGAINS

1—450 HP 6 cylinder, 4 cycle Full Diesel Engine, direct connected to Westinghouse 375 KVA, 3 ph. 60 cyc. 240 RPM AC Generator, dir. con. Exciter, Switchboard & Auxil. Equipment.
1—200 KW G.E. Turbo-Generator 3 ph., 60 cyc., 480 volt, 3600 RPM 150# non-condensing.
1—110 HP Washington 4 cyl. 4 cycle, Full Diesel Engine, 600 RPM.
1—100 KW G.E. Turbo-Generator 3 ph. 2300 volt, 60 cyc., 3600 RPM ATB 125# non-condensing.

SUNDFELT EQUIPMENT CO.
3422 First Ave. South
SEATTLE 4, Wash.

Motor Generator Sets—Synchronous Motors, Etc.

M-G SETS

1—West. 500 KW 275 or 600 Volt D.C. 720 RPM. 2300 Volt 80% P.F. 720 HP A.C.

VERTICAL MOTORS

1—Reliance fan-cooled 25 HP 1750 RPM 220/440 Volt

SYNCHRONOUS MOTORS
3 phase, 60 cycle, A. C.

1—Ideal 3-bearing 250 HP 600 RPM 440 Volt
1—Burke 300 HP 900 RPM 440/220 Volt
1—Ideal 50 HP 600 RPM 2300 Volt

SLIP RING MOTORS, 3 phase, 60 cycle

Allis-Chalmers 250 HP 600 RPM 440 Volt
G. E. 62½ HP 1150 RPM 440/220 Volt

SQUIRREL CAGE MOTOR SPECIAL
3 phase, 60 volts

5—West. frame 405, 20 HP 900 RPM TEFC 220 Volts

D. C. EQUIPMENT, 230 VOLT

1—G.E. MPC 150 HP 262/750 RPM
1—Triumph 110 HP 292/600 RPM
1—Diehl 125 HP 400/1200 RPM

A large number of adjustable speed D.C. motors from 5 to 100 HP.

ALTERNATORS SPECIAL, Allis-Chalmers, 125 KVA 277 RPM 3 Phase, 60 Cycle

The Electric Motor & Repair Co., Cuyahoga Falls, O.

DIESELS

ROBERT SCHOONMAKER
Port Washington, Long Island, N.Y.
Phone Roslyn 1220

Rot. Con.—M-G Sets 3 ph. 60 cy.

3—300 KW G.E. HC 12 Rotaries 275 v. 6 ph. with 2300 v. 3 ph. 60 cy. Transformers.
200 KW Ridg. 250 v.—2200 v. 1200 RPM.
100 KW West. 125v—2200/440/220 Syn.
100 KW Ridg. 250v—2200/440/220 Syn.
50 KW G.E. 125v—230/440 Ind.

AC and DC GENERATORS

200 KVA G.E. 2200/3/60 720 RPM. AC.
100 KW Westgh. Type M. 250 v. 580 RPM.
75 KW G.E. 125 v. 700 RPM. DC.
50 KW G.E. 125 v. 1750 RPM. DC.
45 KW West. SK 125 v. 700 RPM. D.C.

AC & DC STEAM GEN. SETS

100 KW West. 250 v. DC—Skinner
57½ KVA Al. Ch. 220/3/60 3600 RPM Turbo
50 KW West. 125 v. DC—Skinner
50 KW 125 v. DC Westgh. Turbo Gen.

AC MOTORS 3 ph. 60 cy.

HP	Make	Type	Speed	Wdg.
1500	West.	CW	435	S.R.
1000	G.E.	KT	514	S.C.
500	G.E.	MT 412	435	S.R.
300	West.	CW	1750	S.R.
200	G.E.	IM	495	S.R.
200	West.	.8 P. F.	900	Syn.
200	G.E.	MT 412	240	S.R.
187	G.E.	IM	600	S.R.
150	G.E.	.8 P. F.	900	Syn.
150	West.	CW	375	S.R.
150(2)	West.	CCL	600	S.C.
150	G.E.	IL	600	S.C.
125	G.E.	IK	720	S.C.
100	G.E.	IK	1150	S.C.
100	G.E.(25 cy)	MI 108	490	S.R.
100	Al. Ch.		690	S.R.
100	West.	CI	1750	S.R.
60	Lincoln		900	S.C.
50/12½	G.E.	IM	450/900	S.R.
50	G.E.	KT	1160	S.C.
40	Triumph	TR	1760	S.C.
25	G.E.	KT	1160	S.C.
25	West.	CW	575	S.R.

Also large number of smaller motors.

MISCELLANEOUS

1—355 cu.ft. 100# 12 x 10—ER 1 Ing. Rd.
500/700 HP Morse Chain 4.28 to 1
250 HP Falk Gear 12.7 to 1
150 HP Nuttal 1.6 to 1

DC MOTORS

HP	Make	Type	Speed	Voltage
230	G.E.	MD109.5	475	500 ser.
175	G.E.	MDS 109.5	475	230 ser.
130	G.E.	CO 1812	550	230 ser.
140	West.	MC 90	500	500 ser.
105	G.E.	CL	700	230 cp.
100	G.E.	MD 108	550	230 ser
100	G.E.	DLC	575	110 cpd.
60	G.E.	CO 2507	600	230 ser.

Also large number of smaller motors

MOORHEAD-REITMEYER CO. INC., Pittsburgh 19, Pa.

SMALL COMPLETE PLANT—BARGAIN

1—500 KVA Allis turbo generator 60/3/2300V/3600 RPM with surf. cond. all auxs. Boilers: 1—350 HP B&W 160#, 1—240 HP 160# Stirling. 2—oil pumps, 6—gas pumps, 1—duplex Steam pump, 1—feed water heater—Other Plants Complete.

NON-COND. TURBOS

1—1000 KW Wemco 60/3/2300V/1800 RPM/150# 10# B.P.
1—1000 KW Wemco turbine. 350#, 700° T.T.—gen. new or used avail.
1—1000 KW G.E. 60/3/480V. 150# 100° S.H. 30# B.P.
1— 500 KW G.E. 60/3/2300V. 100-125#, 2# B.P. New 1924.
1— 300 KW G.E. 60/3/240V. Bleeder, 4000# per hr. 10# B.P.
1— 500 KW Wemco mult. exp. parallel flow 60/3/440V/3600 RPM 150-200# 10# B.P.
1— 750 KW Moore 200# 100° S.H. 10# B.P. 75# ext. with 2—633 HP boilers.

COND. TURBOS

1—6000 KW Wemco 76 CW, 60/3/2300/225# equal new.
1—4000 KW G.E. 60/3/2300V/200# 125° S.H. surf. cond.
1—3000 KW G.E. Curtis 60/3/2300V/150# surf. cond.
1—2000 KW Wemco 60/3/440V/180# surf. cond.
1—1250 KW Wemco Bldr. 60/3/480V/150#/120° S.H. 3600 RPM Bldg. 15#G, 15,000# per hr.
1—1250 KVA Allis A.C. 60/3/2300/3600 RPM 150-200#, 100° S.H.
1—1560 KVA Wemco A.C. 60/3/600/3600 RPM mixed flow Wemco 4200 sq. ft. surf. cond.

ASME BOILERS

1—1250 HP steam generation plant complete. Superheater, Economizer, Steel encased 14 retort stoker, 100,000# Cont.
2—612 HP 200# 125° S.H. Stirling.
4—500 HP Heine 190# 150° S.H.
2—500 HP B&W 200# 100° S.H. Comb. Eng. Type E stoker all auxs.
1—500 HP Edgemoor 175# Comb. Eng. Type E stoker
2—365 HP Edgemoor 200# 100° S.H. Ram type stoker.
1—313 HP 250# Edgemoor 125° S.H. stoker.
1—200 HP Brownell HRT 125# New 1936; Stoker.
2—125 HP Leffle Scotch Marine 125# Oil Burners.
1—305 HP Kidwell 185#, 125° S.H. Stoker.

50 YEARS OF SERVICE

LET US PLACE YOUR MODERN IDLE EQUIPMENT

MOTORS • GENERATORS • TRANSFORMERS

MOTORS

25 Cycle—3 Phase—2200 Volts

3—150 HP, Gen. Elect. Ball Bearing type KT557Y 1500 RPM, Serial # over 5 million

MOTOR GENERATOR SETS

1—40 KW Gen. Elect. 230 V. DC. Type DLC. Direct connected to 50 HP. Gen. Elect. KT. Motor 3/60/440 V. 720 RPM.
1—125 KW Ridgeway 250 V. DC. 1200 RPM. direct connected to 180 HP. Ridgeway Motor. 3/60/440 Volts 1200 RPM. DC. Panel and Starting Compensator.

SPECIAL OFFER

1—75 HP. Westinghouse Slip ring motor. 3/25/220/440/500 RPM. Sealed Sleeve Bearing.

FREQUENCY CHANGER SET

1—1250 KVA Gen. Elec. Synchronous—motor 3/25/2200 750 RPM direct connected to Generator 362½/440 V. Complete with exciters and panels.

25 CYCLE SYNCHRONOUS MOTOR

1—100 HP. Electric Machinery Co. Synchronous. Motor 3 phase 25 cycle, 440 Volt 300 RPM.

TRANSFORMERS

3—150 KVA. General Electric Type H, Form KS. 2400 Volts Primary 120/240 Volts Secondary.

60 CYCLE MOTOR

1—200 HP. Electric Machinery Synchronous Motor. 3 phase 60 cycle 440 Volt, 720 RPM.

REBUILT MOTORS

3 Phase 60 cycle 220/440 Volts

HP	Make	Type	RPM	Serial No.
7½	General Electric	KT952	1200	4593120
7½	Fairbanks-Morse	HJ-10BB	900	157685
7½	Fairbanks-Morse		1200	476598
10	Westinghouse	CS	900	2174616
10	Star	BB	3600	90847
15	U. S.	STB-BB	720	55379
15	Crocker Wheeler		600	131413
15	Westinghouse	CS	1200	1883285
15	Westinghouse	MS	1200	944593
20	Westinghouse	CS	1200	2160590
20	Star	BB404	1200	10581
20	Westinghouse	MS	1200	1056826
20	Westinghouse	MS	1200	1246745
20	Westinghouse	MS	1200	1056827
20	Westinghouse	CS	1800	1863526
20	Westinghouse	CS	1800	1930159
20	Westinghouse	CS	1800	2695044
25	Westinghouse	MS	1800	1562026
25	Westinghouse	MS	1800	1334763
25	Westinghouse	CS	1200	2286768
25	Westinghouse	MS	1200	1197673
25	Wagner	BP	1200	126906
30	Armor	BB	720	4343
30	Crocker Wheeler		720	17270
30	Westinghouse	MS	1200	1197674
30	Fairbanks-Morse	V-H-10D	1800	43476
40	Westinghouse	CCL	350	581480
40	Westinghouse	CS	900	1896969
40	General Electric	I-K	1800	73318
40	General Electric	I-K	1800	68511
40	General Electric	I-K	1800	77017
40	General Electric	I-K	1800	73316
40	Westinghouse	MS	1800	1506800
40	Westinghouse	MS	1800	1051548
40	Westinghouse	MS	1800	1056802
40	General Electric	I-K	1200	181444
40	Westinghouse	MS	1200	1027421
50	Westinghouse	CCL	400	541841
50	Westinghouse	MS	1800	1289389
50	Westinghouse	MS	1200	854410
50	Westinghouse	CS	1800	2691183
50	Westinghouse	CS	1800	1949877
50	General Electric	14	1800	181444
50	Reliance		1800	Z20194
50	Allis Chalmers		1800	3K28825
60	Westinghouse	CS	900	4884402
60	Reliance		1200	B11458
60	Westinghouse	CCL	450	518408
60	General Electric	I	1800	292596
60	Westinghouse	CCL	1800	329654
60	Robbins-Myers	K	1800	P515362
60	Triumph		1800	C14248
60	Westinghouse	CCL	1200	854121 (2200 v.)
75	Westinghouse	CCL	514	450185
75	Westinghouse	CS	1800	2134671
100	Westinghouse	CCL	600	416173
100	Westinghouse	CS	900	2207524
100	Westinghouse	CCL	1800	1043213
100	Westinghouse	CCL	1800	765231 (2200 v.)
125	Westinghouse	CCL	720	427284
125	Westinghouse	CS	1200	2318625
150	Westinghouse	CS	1800	2429726
150	Westinghouse	CCL	900	438385
150	General Electric	KT557	1200	5269860
150	General Electric	KT557	1200	5260126
150	Westinghouse	CS	1200	4572596 (2200 v.)
150	General Electric	I-K	720	122809 (2200 v.)
150	Westinghouse	CCL	720	808349 (2200 v.)
200	General Electric	I-K	900	232917 (2200 v.)
200	Westinghouse	CCL	900	919537 (2200 v.)
250	General Electric	I-K	600	2246834
300	General Electric	I-K	720	2357743
400	General Electric	I-K	900	2347845

SLIP RING MOTORS

3 Phase 60 cycle 220/440 Volts

HP	Make	Type	RPM	Serial No.
1	Westinghouse	CW	1200	5348371
1	General Electric	MT122	1200	232163
1	General Electric	MT122	1200	3797628
1	General Electric	MT122	1200	2323624
1½	General Electric	MT140	1200	1416002
1½	General Electric	MT140	1200	811798
15	General Electric	I-M	900	1225084
15	General Electric	MT322	855	3088717
13	K.W. Sachsenwerk	D7-3/8	850	295481
20	Westinghouse	CW644C	575	8009992
20	General Electric	MT332	545	3889010
30	Westinghouse	HF	1745	1558408
40	Westinghouse	CW748	690	4406823
40	Westinghouse	CW748	690	4406825
40	Westinghouse	CW748	690	4406821
40	Westinghouse	CW748	690	4406819
40	Westinghouse	CW748	690	4405824
250	Allis Chalmers	3 bearing	505	104390 (2300 v.)
400	General Electric	I-M	900	224674
400	General Electric	I-M	900	246762

ERIE ELECTRIC CO., INC.

124 CHURCH ST. BUFFALO, N. Y. CL. 4758

SEARCHLIGHT SECTION

PUMPS MOTOR & STEAM DRIVEN

G.P.M.	Head	Make	Type
9700	110'	Ing. Rand	Centrif.
6000	33'	LeCourtenay	Centrif.
3500	140'	Kingsford	Centrif.
2400	55'	American	Centrif.
1100	220'	Allis-Chalm.	Centrif.
1500	160'	De Laval	Centrif.
400	625'	LeCourtenay	Centrif.
250	525'	LeCourtenay	Centrif.
400	350'	Goulds	Triplex
300	500'	Goulds	Triplex
175	500'	Goulds	Triplex
500	175'	Blackmer	Rotary
450	231'	Kinney	Rotary
300	150'	Viking	Rotary
1000	460'	Knowles	Steam
750	460'	Snow	Steam
500	460'	Worthington	Steam
2000	50'	Lawrence	Sump
300	231'	Gardner	Plunger

M. G. & STEAM DR. SETS

K.W.	Make	Volts	Type
25	Green Eng.	220 D. C.	Belt Drive
100	Ames	240 D. C.	dir. dr. Eng.
75	Ames	240 D. C.	dir. dr. Eng.
17	Sturt. Turbine	110 D. C.	Direct Drive
7½	Sturt. Turbine	110 D. C.	Direct Drive

D.C. MOTORS ALL SIZES

100 Northwest	220	1750
25 Roth	230	1750
10 Crock. Wheel	110	925
10 Wmche.	110	1700

½ to 7½ H. P. ALL MAKES

CONDENSATION RETURN UNITS

Nash-Jenn Dup. Vac. Heat. 26000EDR
Nash-Jenn Simp. Vac. Heat. 16000EDR
Condensation Units 100 to 250,000EDR

AIR COMPRESSORS

C.F.M.	Pressure	Make	Type
850	100	Laidlaw	Hor. Dup.
500	60	Ing. Rand	Steam
400	125	American	Horiz.
350	40	Worthing	Horiz.
125	100	Gardner	Vert. Dup.
173	100	Ing. Rand	Horiz.
28	5000	Norwalk	4-Stage

TURBO-CENTRIFUGAL BLOWERS

3000	16 lbs.	In. Rand	Motor dr.
3000	8 lbs.	In. Rand	Motor dr.
900	5¼ lbs.	In. Rand	Motor dr.
700	2½ lbs.	Allen Billmyer	Motor dr.
675	24–45 oz.	Spencer	Motor dr.
250	3.2 lbs.	Spencer	Motor dr.
250	16 oz.	Spencer	Motor dr.

BLOWERS & EXHAUSTERS

C.F.M.	St. Pres.	Make	Type
100–60000	¼"–5'	Buffalo	Various
100–15000	¼"–16 oz.	American	Various

ROTARY PRESSURE BLOWERS

C.F.M.	Press	Make	Type
15000	2 lbs.	I-R-Turbo	Direct dr.
6000	3 lbs.	Roots	Belt dr.
3000	3 lbs.	Roots	Belt dr.
2000	3 lbs.	Sturt.	Belt dr.
1000	3 lbs.	Roots	Belt dr.
200	5 lbs.	Baker	Direct dr.
110	15 lbs.	Beach R	Belt dr.

VACUUM PUMPS

1000	15 in.	Roots	Belt dr.
350	27 in.	Worth	Belt dr.
100	high vac	Beach R	Gear dr.
100	27 in.	Deane	Belt dr.
100	29 in.	Devine	Belt dr.

MOTORS (3 ph. 60 cy.)

HP	Make	Volts	Speed	Type
300	G.E.	2300/4000	1800	Syn
150	West.	440	700	CS
125	G.E.	220	1150	Vertical
100	Lincoln	220	1750	
50	G.E.	2300	1750	I
50	West.	220	850	CCL
50	West.	220	570	CS
40	G.E.	220	870	342
30	Wagner	220	850	al. rg.

Also 10 to 30 H.P. in All Makes

SIMILAR EQUIPMENT IN STANDARD MAKES AND SMALLER SIZES
HIGHEST PRICES PAID FOR YOUR IDLE EQUIPMENT

SUPERIOR EQUIPMENT CO.

138 Grand St., N. Y. C. Tel. CAnal 6-6983-4

STEAM ENGINES
Turb. Cent. Bronze Pumps
Steam Pumps—All Sizes
10"x10" Greenfield Vertical
7"x7" Wickes Bros. Vertical
6"x6" Vertical & Smaller
1 to 40 H.P. Steam Turbines

11000 FT. SUR. COND.

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2—4166 GPM. 162' hd. Cent. Pumps (Prac. NEW)

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4—600 A. GE FK 12 3 PST 15,000 V. Handle. Trip Coils and Currents.
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1—1200 A. GE FK 132 A 3 PST 7500. Handle with Trip Coils and Current Tranformer.
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1—3000 A. GH FK 25 Oil Breaker 3 PST 600 V. Solenoid operated with currents.

Sq. Cage.—220/440 V. 60 Cy. 3 ph.

Qu.	HP	Make	Type	Speed
2	50	G.E.	KT 327	1800
2	100	G.E.	IK	1800
1	150	West.	CS	1800

Slip Ring—220/440 V. 60 cy. 3 ph.

1	40	West.	CW	720
1	50	G.E.	I-M	900
1	60	G.E.	I-M	900
1	75	West.	CW	900
1	250	West.	CW	1200

D. C. Variable Speed 230 V.

1	15	West.	SK	400/1600
1	25	West.	SK	400/1200
1	50	West.	SK	500/1500
1	50	G.E.	CD	400/1600

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1—Platt Iron Wks. Cr. Comp. C&FW Meyer Valve Gear Cond. 1000 GPM. Size 14x28x9¾"x18.

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Birch Valves for all types of reciprocating pumps.

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526 CFM Ingersoll Rand, Style "J"
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2—1200 HP, 6 Cyl., Nelseco M.A.N. Design, 4 cy., 300 RPM.
3—2350 HP, 10 Cyl., Nelseco M.A.N. Design, 4 cy., 300 RPM.
6—2350 HP, 6 Cyl., Busch Sulzer, 2 cy., 300 RPM.

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500 KW. DC motor generator, 600 v. DC 900 speed, Allis Chalmers. Can assemble for any AC voltage drive

400 KW. 3 unit 250/500 volt General Electric synchronous motor generator set, 2300/4000 volt AC drive

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1—400 HP Westinghouse, type CW, 3 ph. 60 cy. 440V, 450 RPM slip ring motor
1—300 HP General Electric, 3 phase, 60 cycle, 440 volt, 360 RPM, type Mt 412 slip ring motor
1—275 HP Allis-Chalmers, 3 phase, 60 cycle, 440 volt, 1175 RPM slip ring motor
1—200 HP Allis-Chalmers, 3 phase, 60 cycle, 440 volt, 1150 RPM slip ring motor
2—100 HP General Electric, type I, form K, 3-60-220V 575 RPM
1—100 HP Westinghouse, type CCL, 3 ph, 60 cy, 2200 V, 1750 RPM, Squirrel Cage
1—100 HP Allis-Chalmers, type ANY, 3 ph, 60 cy, 220V, 580 RPM slip ring
1—100 HP General Electric, 3 ph, 60 cy, 4000V, 720 RPM syn., type TS with direct connected exciter
2—100 HP Crocker Wheeler, size 2AQ, 3 ph, 60 cy, 440V, 385 RPM slip ring
1—100 HP Westinghouse, type CS, 3 ph, 60 cy, 440V, 1750 RPM sq. cage
4—75 HP G. E. 3-60-2300V, 400 RPM, type I, sq. cage
1—75 HP General Electric, 3 phase, 60 cycle, 440 volt, 450 RPM, type I, form M, slip ring motor
1—75 HP Allis-Chalmers, 3 ph, 60 cy, 440V, 450 RPM slip ring
1—75 HP Fairbanks-Morse, type H, frame 105C, 3 ph, 60 cy, 550V, 900 RPM Squirrel Cage
1—75 HP Lincoln, type IQ, 2 ph, 60 cy, 3 phase, 440V, 600 RPM Squirrel Cage
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1—60 HP General Electric, 3-60-440V, 1750 RPM, type I slip ring
1—60 HP General Electric, 3 phase, 60 cycle, 440 volt, 600 RPM, type MT 556 slip ring motor
1—50 HP General Electric 3-60-220V, 1150 RPM, type I, slip ring
1—50 HP Triumph 3-60-440V, type C12 1150 RPM, slip ring, rotor & stator rewound
1—50 HP General Electric, 3-60-440V, 900 RPM, type I-M, slip ring
1—50 HP General Electric, 3-60-440V, 720 RPM, type IK, Sq. Cage
2—50 HP Allis-Chalmers, 3-60-440V, 890 RPM slip ring
1—50 HP General Electric 3-60-440V, 690 RPM, MT 546, slip ring
1—50 HP Wagner 3-60-440V, 495 RPM, type BM, Sq. Cage
1—50 HP Allis-Chalmers, 3-60-440V, 490 RPM, Sq. Cage
1—50 HP Westinghouse CS 2-60-440V, 420 RPM, Sq. Cage
1—50 HP Allis-Chalmers, 3 ph, 60 cy, 550V, 860 RPM Sq. Cage
1—50 HP General Electric, type I-M, 3 ph, 60 cy, 440V, 720 RPM slip ring
1—45 KVA Fairbanks-Morse, 3 ph, 60 cy, 220V, 1200 RPM alternator
2—30 HP Fairbanks-Morse, 3 ph, 60 cy, 220V, 3600 RPM, type HO, frame 12B ball bearing
1—50 KW, Allis-Chalmers, factory-built, 3 bearing M-G set, 125 volt DC, driven by 75 HP, 3 phase, 60 cycle, 220 volt, 1165 RPM motor
2—175 HP, 230V, DC Westinghouse, type SK, 150 to 550 RPM
1—100 HP General Electric, type CD, fr. 123, 230V, 1200 RPM
1—60 HP Westinghouse, type SK140L, 115V, 1150 RPM vertical
1—50 HP Westinghouse SK200, 230V, 250/900 RPM

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All of these units in good shape for immediate service

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6—1 H.P. 440-3-60 Westinghouse induction motors 1,725 R.P.M.

6—2 H.P. 440-3-60 Westinghouse induction motors 1,140 R.P.M.

1—18 Inch Cochrane Multiport back pressure valve.

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2—Nicholson weight operated Traps No. 5—1½ inch.

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1—18 x 10 x 12 Underwriters approved steam fire pump. 1000 g.p.m. 100# pressure 70 R.P.M. Caesar Brothers N. Y. $300 on foundation.

P. O. BOX 852, LA CROSSE, WISCONSIN

POWER PLANT EQUIPMENT

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One 250 K.V.A. and one 300 K.V.A. Crocker Wheeler Generators direct connected to Skinner Tandem compound engines—480 volts—3 phase 60 cycle, switchboard, instruments, piping.

One 300 K.W. General Electric Generator, 2300 volts, 3 phase, 60 cycle, direct connected to Curtis Steam Turbine, 175 lbs. pressure—3600 R.P.M. with 15 K.W. G.E. direct connected exciter.

ELECTRIC MOTORS

Induction Type—220 Volt—2 Phase—60 cycle
One 5 H.P. Burke—Type EB 5—1130 R.P.M.
One 5 H.P. Burke—Type EB 75—900 R.P.M.
One 7½ H.P. Robbins & Myers—Type K—850 R.P.M.
One 10 H.P. Burke—Type EM 1.2—1200 R.P.M.
One 10 H.P. Burke—Type EM 1.2—900 R.P.M.
Two 20 H.P. Burke—Type EM 3—1200 R.P.M.
One 20 H.P. Crocker Wheeler—1170 R.P.M.
One 35 H.P. Burke—Type EM 4.5—900 R.P.M.
One 50 H.P. Burke—Type EM 4.5—1200 R.P.M.
One 150 H.P. Westinghouse—Type CW—1765 R.P.M.

PUMPS

One Quimby 4 stage Centrifugal pump direct connected to 75 H.P. G.E. motor—220 volts—3 phase, 60 cycle, 1750 R.P.M.—500 G.P.M. 150 lbs. pressure.

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One Goubert feed water heater with brass tubes —330 sq. ft. heating surface.

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One 444 H.P. Union Iron Works, water tube steam boiler 200 lb. working pressure, pulverized coal or oil fired.

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40 H.P. Nagle vertical steam engine, Class F, 12" cylinder, 12" stroke, flywheel 54"x12½".

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One Allis Chalmers 150 K.W., 125 - 250 V. Erie Ball D.C.

ENGINE GENERATOR SET

SPECIFICATIONS

Generator	Engine
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Amps. 600	Bore & Stroke 16 x 20
R.P.M. 200	Four valve
Compound Wound	non-releasing

Equipped with Allis Chalmers 13.3 K.V.A., A.C. transformer and panel board.

In good operating condition

KELLY & CO.
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8 Babcock and Wilcox 500 HP Sterling water tube boilers 200 lb. pressure.

With Westinghouse Taylor stokers, soot blowers, gauges and recording thermometer and CO_2 recorder. Also blowers, ash cars, conveyors, crushers, elevators and feed pumps. A complete power plant only slightly used.

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DeLaval Steam Turbine AND Centrifugal Pump Unit

Turbine-Type TC #30209, Steam Pressure 150, Speed 1170, Exhaust Pressure 28" Vac. Pump-Type 2 P6 —Total head 286, Speed 1170. Gallons per minute, 1050.

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1—1200 HP B&W Sectional Header Boiler, 250# pressure, underfeed stoker.
1—450 HP Murray Bent Tube Boiler, 200# pressure
1—526 HP Heine Boiler 350# pressure.
1—90,000# per hr Badenhausen Boiler, 354# pressure.
2—502 HP and 2—454 HP Sterling Boilers, complete plant.
1—444 HP Union Iron Works Boiler, 225# pressure.
1—624 HP Edgemoor Boiler, 200# pressure, underfeed stoker.
1—221 HP B&W Sectional Header Boiler, 250# Pressure, with oil burners.
4—72" x 18' HRT boilers including a 637 KVA General Electric condensing turbine. Complete plant.
2—175 HP Brownell HRT Boilers, 150# pressure, rebuilt.

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2—5000 KW Westinghouse 3600 RPM 3-60-2300 volts Condenser, all auxiliaries.
1—3200 KW Allis-Chalmers Condensing Turbine with auxiliaries.
15,000 KVA Westinghouse turbine, condenser.
1—250 KVA Waite Turbine either condensing or non-condensing.

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1—625 KVA Nordberg Uniflow engine.
1—1060 KVA Nordberg Uniflow Engine Generator.

DIESEL ENGINES

1—200 KVA Fairbanks-Morse Full Diesel Engine Generator.
1000 KVA Diesel Generator Plant complete.
1—Busch Sulzer Full Diesel direct connected 1335 KW AC generator, rebuilt and guaranteed.
1250 KVA Nelesco engine generator.

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1—250 KVA Skinner Uniflow Engine, panel board, 3-60-240 Volts.
1—400 KVA Allis-Chalmers non-releasing Corliss.
1—625 KVA Bates Corliss engine.
1—7 ft. diameter by 175 ft. self-supporting stack.

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54,000 pound Cochrane hot process lime and water softener.
2500 HP Cochrane Open Feed Water Heater.
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2—6 Retort Taylor Stokers. First-Class condition.
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1—232 GPM Centrifugal Boiler Feed Pump, turbine driven, 1200 ft. head.

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DIESEL GENERATING UNIT M.A.N. built by Nelseco 375 KVA complete 3/60—2300 volt, used 10 years as standby

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1 Heine safety water tube Boiler. 300 H. P. 200# pressure. 175-3½" x 18'. Tubes 3060 square feet. Heating surface. Built 1939.

These boilers are in our basement, and must be hoisted through an opening in the alley dock floor.

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1—300 HP Y V F & M Engine. Will sell for spare parts.
3—240 HP Y V A F & M Engines direct connected to 200 KVA Generators, Board & Starting.
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3—120 HP Y V A F & M with or without Generators.
3—360 HP Allis Chalmers Gas Engines with Generators & Boards.
6—14 x 17 Y V A F & M Cylinders, Pistons & Heads.
Generators 50 KW up.
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New National Duplex Boiler Feed and General Service Pump, Capacity 49 G.P.M. For other details write

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1—484 HP Springfield Boiler, type WT, 200# pressure.

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1—10x7x13 #52332 Cameron Water Pump 5" Suc. 4" Dis.

1—10x5x13 #5237 Cameron Water Pump 4" Suc. 3" Dis.

1—Elliott-Pittsburgh Water Heater #3072, type CD-7.

2—12798 Gallon Oil Storage Tanks.

1—200 Gallon Coal Oil Tank.
Height of boiler, 17' 8¼", area dimension 19' 8" by 13' 5". Manufacturer's serial #3077, A.S.M.E. number 59, Hartford number 798.

Tubes: 288—3" O. D. x 18'
48—3" O. D. x 10' 8½"
48—3" O. D. x 5' x 3½"

Drum Size: 54" Diameter, 13' 5" length. Steam outlet 8". Feed water inlet 2½".

We offer the above water tube boiler and accessories, all as now mounted at $3,000.00.

MOTOR GENERATOR SET

1—35 KW, 120/240 volt, 850 RPM, 140 Amp., type RC15, tag 9224, serial #484918, form O, three wire compound wound, interpole General Electric D.C. generator, like new, with General Electric type M auto transformer. We offer this unit with A.C. motor, any voltage, at $1,000.00.

1—50 KVA, 13,200 to 220-110 volt, single phase, 60 cycle Westinghouse transformer #287911.

3—300 KVA, 13,200 to 6900 volt, single phase, 60 cycle Westinghouse transformers, serial numbers 414645-517432 and 524833.

3—100 KVA, 11,000-22,000 to 220-440 volt, single phase, 60 cycle Allis Chalmers transformers, with four taps, serial numbers 1A3286.1-1 A3286.2 and 1A3286.3.

Erie Ball single slide valve, 257 RPM, #4911, bore 13", stroke 16", 100 lb. steam pressure engine direct connected to 100 KW General Electric 257 RPM A.C. 220 volt, 3 phase, 60 cycle generator.

18x24 Chuse non-releasing Corliss right hand engine 200 RPM complete with throttle valve, lubricator, direct connected to a 200 KW, General Electric 250 volt D.C. generator with switchboard or we have an A.C. generator which we can mount on this unit.

Also twenty-four larger gas and Diesel plants up to 60 KVA. Fine for standby service.

PORTER ELECTRIC COMPANY

612 Third Ave. South — Minneapolis 2, Minn.

GEneva 8655

ELECTRIC POWER PLANT EQUIPMENT COAST TO COAST

Steam Turbine-Generator

1—Curtis Steam Turbine, G.E. Co. #28694, 60 KW, 1200 RPM, Type D.51, 1-stage, 100-125 steam pressure, non-condensing.

1—Generator, G.E. Co. #4019578, AC, IS-350078-41, Type ATB-6-75-1200, Form PB, 240 v., 1200 RPM, 180 amp. armature, 60 cycle, PF-8, 3-phase, 10.5 amp. field, 60 KW.

1—Exciter, #255538, DC generator, direct connected, Frame 3, Type EP, Form E, IS-350043-1, 16 amp., 1200 RPM, 125 volts no load, 125 volts full load, 2 KW.

1—Operating Switch Panel—1 Oil Circuit Breaker, G.E. Co. Type HA2; 1 Amp. Meter; 1 Voltmeter; 1 Field Switch; 1 Amp. Switch; 1 Volt Switch.

2—Rheostats. 2 Current Transformers.

2—Auto Transformers, No. 3067783, 5 KVA, output 10, G.E. Co. #189910, 220 to 220/110 volts.

1—8" Crane Co. #25-384 Vertical Back Pressure Valve.

1—8" Swartwout Cast Iron Exhaust Head.

1—8" Crane Co. #150 Gate Valve Iron Body.

$750.00 f.o.b. cars.

Independent School District

1221 Pierce St., Sioux City 18, Iowa

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This advertiser desires to enter into an arrangement with one, or possibly two established companies, one east and the other west of Chicago, for them to manufacture, market and sell, the above noted stokers. 25 years of research, development and practical experience in America and abroad, are incorporated in these spreader stokers.

FS-820 POWER

330 West 42nd St., New York 18, N. Y.

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in

New and used equipment recently released from service by a number of electric and gas utility companies

POWER PLANT EQUIPMENT
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EBASCO SERVICES INCORPORATED

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Two 250 horsepower, cross drum, horizontal watertube boilers, Ohio Standard, equipped with Iron Fireman pneumatic stokers, 150 pounds pressure.
One 72 inches by 18 feet HRT boiler, National Board, equipped with Iron Fireman pneumatic stoker, 150 pounds pressure
Two boiler feed pumps
One feed water heater

M & R Dietetic Laboratories, Inc.

Columbus 16, Ohio

Four Worthington Steam Pumps

14x8½x10 - 14x7x10 - 7½x5x12
18x9x12

ALSO SMALLER DUPLEX PUMPS

ACORN IRON & SUPPLY CO.

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FOR SALE

One Brine Cooler—Six Pass—horizontal steel tubes
One Hayward Clamshell Bucket Type "E" ¾ yd. cap.
One 10" Centrifugal Pump
One 12" Centrifugal Pump

Also steam pumps, valves, etc.

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Hopewell, Va.

FOR SALE

One—Chicago Pneu. Type 68-CP. 225 HP. 720 RPM

6 Cylinder Diesel Engine

Serial #30-412, excellent condition, operated less than 2 years—also auxiliary equipment including starting air compressor, 300 lb. pressre air tank, lubricating oil tank purifier, fuel oil transfer pump, and new spare parts, further details and price upon inquiry.

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Duluth, Minn.

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one Ames high speed direct connected engine 325 RPM 25 KW DC generator. Price reasonable.

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125 H.P. Engine Complete

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56 RUTTER STREET
ROCHESTER, N. Y.

1—Complete Coal Pulverizing Unit designed for 2000 lbs. per hour—includes Simms Co. Pettibone unit pulverizer, size G2 with compensating starter and switch.
1—Dings Magnetic Starter.
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1—Bucket Conveyor 10 ft. high.
All equipment new except Bucket Conveyor.

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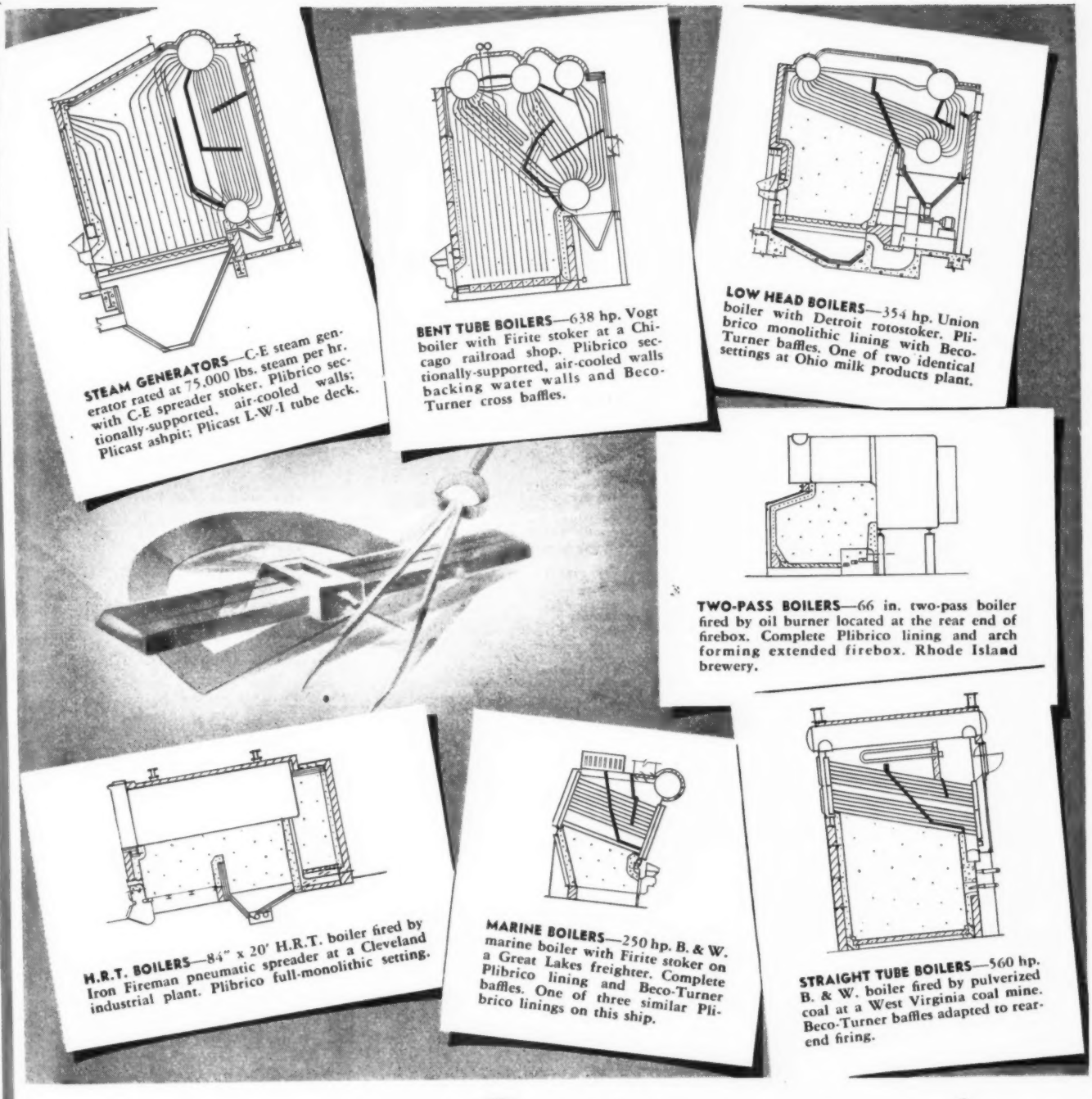

STEAM GENERATORS—C-E steam generator rated at 75,000 lbs. steam per hr. with C-E spreader stoker. Plibrico sectionally-supported, air-cooled walls; Plicast ashpit; Plicast L-W-I tube deck.

BENT TUBE BOILERS—638 hp. Vogt boiler with Firite stoker at a Chicago railroad shop. Plibrico sectionally-supported, air-cooled walls backing water walls and Beco-Turner cross baffles.

LOW HEAD BOILERS—354 hp. Union boiler with Detroit rotostoker. Plibrico monolithic lining with Beco-Turner baffles. One of two identical settings at Ohio milk products plant.

TWO-PASS BOILERS—66 in. two-pass boiler fired by oil burner located at the rear end of firebox. Complete Plibrico lining and arch forming extended firebox. Rhode Island brewery.

H.R.T. BOILERS—84" x 20' H.R.T. boiler fired by Iron Fireman pneumatic spreader at a Cleveland industrial plant. Plibrico full-monolithic setting.

MARINE BOILERS—250 hp. B. & W. marine boiler with Firite stoker on a Great Lakes freighter. Complete Plibrico lining and Beco-Turner baffles. One of three similar Plibrico linings on this ship.

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RESULTS *Predetermined*—

The outstanding operating records of hundreds of Plibrico boiler settings are no mere coincidence. Every one of these installations reflects the "know-how" of Plibrico engineers — the know-how acquired across the years in dealing with so many conditions that today highest efficiency and economy under any set of conditions can be definitely predetermined.

Your local Plibrico Sales and Service engineer draws on this experience. It will pay you to work with him in connection with any refractory or boiler setting requirement from a new setting down to the smallest repair job. There is nothing too large or too small—no charge or obligation for recommendations or estimates. Write for catalog, stating whether you have water tube or fire tube boilers.

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PLIBRICO JOINTLESS FIREBRICK CO.

1818 Kingsbury Street, Chicago 14, Illinois

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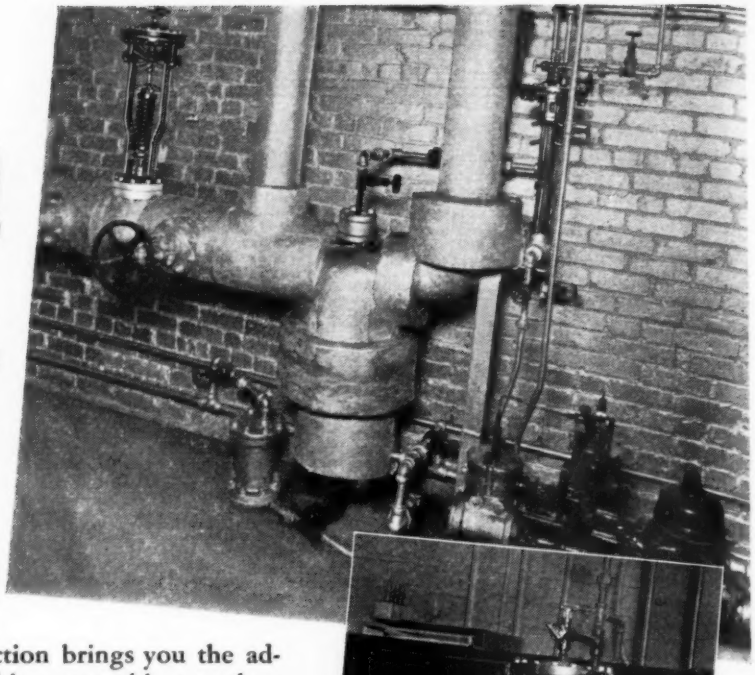
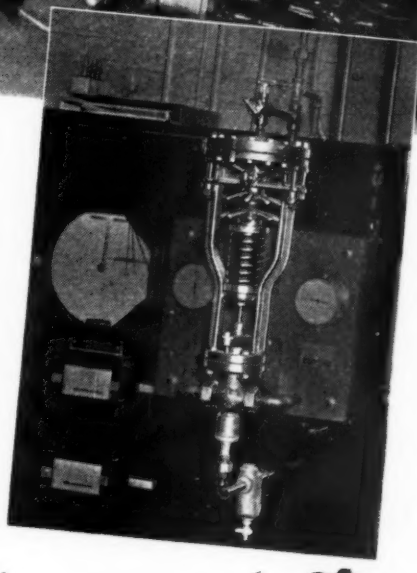
Hold temperature and pressure *on the line!*

...with safe, accurate Swartwout Reducing and Desuperheating Equipment





● A reducing and desuperheating station completely designed by Swartwout to handle your entire job of temperature and pressure reduction brings you the advantage of properly related equipment working smoothly together. You'll find it means much to your sense of security to have the dependable guaranteed control you get with Swartwout Equipment.

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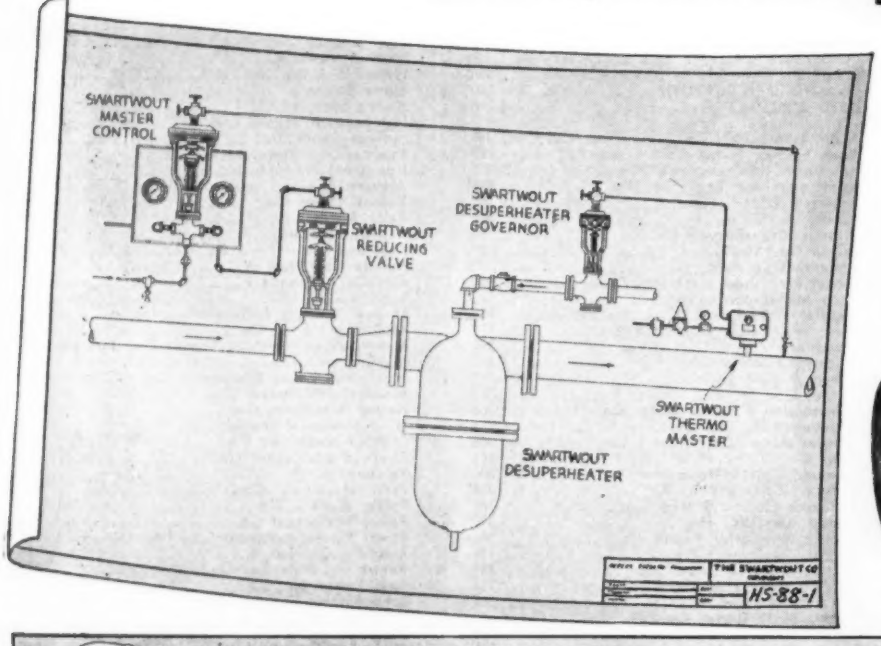
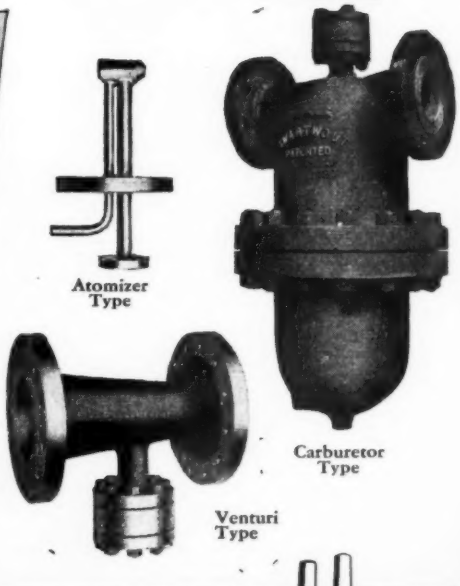
Hundreds of users bank on their Swartwout Reducing and Desuperheating Stations to hold reduced steam temperatures and pressures *on the line*—for safe efficient operation. Check your proposed new or modernization plans with Swartwout.





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Changing factory layouts

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Reconversion, the complete reshaping of manufacturing facilities for peacetime operation, presents many problems. But reconversion is not an entirely new experience for thousands of factories which have long known that progress requires *continual* change . . . that only flexible production facilities can take advantage of new ideas and better methods . . . that machines which cannot be rearranged provide performance just as static as their layout. It was the widespread recognition of these facts and the resulting need for a new kind of motor control to facilitate the relocation of motorized machines that inspired the now-famous Cutler-Hammer UNITROL.

Factories using this most modern of all electrical control equipment gain many advantages. First, UNITROL permits the efficient organization of control at *centralized* locations where it is out of the way of machine operators but where it is more conveniently, more safely, and more regularly inspected by maintenance men. Second, UNITROL requires no costly structural provisions for its installation and no expensive building alterations for its rearrangement. Third, UNITROL makes possible the easiest, speediest, and least costly reorganization of production equipment. Only machines, not the control, need be relocated. The individual control units in the UNITROL assembly can be interchanged or replaced at will. Or sections can be added to or taken away from UNITROL much like filing cabinets can be rearranged in an office.

Factories that were fortunate in having UNITROL before the war found dramatic proof of its advantages in changing over to war production, are benefiting again in reconversion, will gain throughout the future whenever progress calls for plant revisions. Many other factories are utilizing reconversion as an opportunity to modernize their motor control, are replacing war-worn and outmoded equipment with UNITROL. Why not ask a Cutler-Hammer engineer to survey *your* requirements? CUTLER-HAMMER, Inc., 1358 St. Paul Avenue, Milwaukee 1, Wisconsin. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto.

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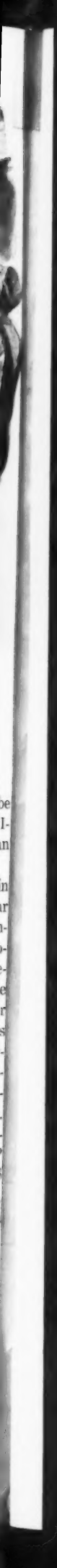
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